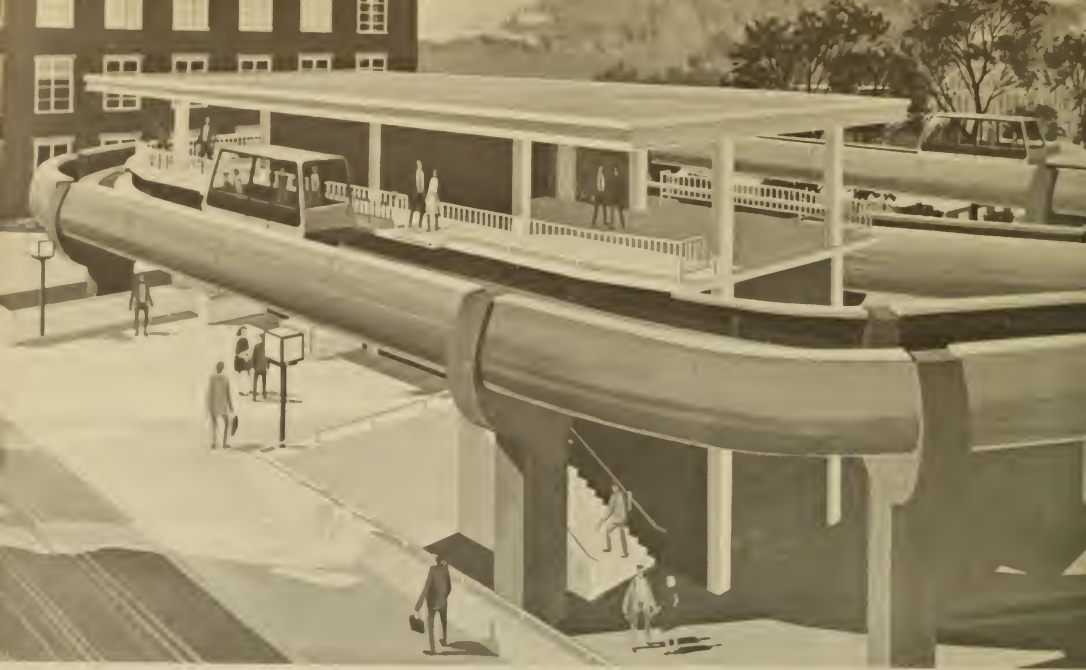




WEST VIRGINIA UNIVERSITY

1972-73 Graduate School Catalog



A modern rapid transit system now under construction will connect WVU's campuses. The internationally unique system will consist of a 3.6-mile guideway and about 80 cars that will carry 15 to 20 passengers each. Peak capacity will be 1,100 people every 20 minutes. The system not only will serve WVU's rapid transit needs, but it is attracting the attention of engineers and researchers from countries that face similar transportation problems. These drawings show the Walnut Street station (above) in downtown Morgantown and the Beechurst Avenue station (below) that will serve the WVU Downtown Campus. The system is being financed largely by the U. S. Department of Transportation as a research and demonstration project.



**WEST VIRGINIA
UNIVERSITY**

**1972-73
Graduate School
Catalog**

CALENDAR 1972

JANUARY							FEBRUARY							MARCH							APRIL						
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
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CALENDAR 1973

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West Virginia University Bulletin/Series 72, No. 7-2, January, 1972
 Issued Monday, Wednesday, and Friday
 Second-class postage paid at Morgantown, W. Va. 26506

UNIVERSITY CALENDAR

1972 — First Semester

August 20, Sunday, to August 22, Tuesday, incl.	Freshman Orientation
August 21, Monday	General Registration, First Semester
August 22, Tuesday	General and Freshman Registration
August 23, Wednesday	First Classes, First Semester
September 4, Monday	Labor Day Recess
September 14, Thursday	English Proficiency Examination
October 10, Tuesday	Faculty Assembly Meeting
October 14, Saturday	Mid-Semester
October 20, Friday	Mid-Semester Reports Due
October 24, Tuesday	Graduate Faculty Meeting
November 22, Wednesday, to November 26, Sunday, incl.	Thanksgiving Recess
December 8, Friday	Last Classes, First Semester
December 11, Monday, to December 16, Saturday, incl.	Final Examinations, First Semester
December 17, Sunday, to January 7, Sunday, incl.	Christmas Recess

1973 — Second Semester

January 8 and 9, Monday and Tuesday	General Registration, Second Semester
January 10, Wednesday	First Classes, Second Semester
February 1, Thursday	English Proficiency Examination
February 7, Wednesday	West Virginia University Day
February 19, Monday	Washington's Birthday Recess
March 1, Thursday	Mid-Semester
March 3, Saturday, to March 11, Sunday, incl.	Spring Recess
March 12, Monday	Mid-Semester Reports Due
March 13, Tuesday	Graduate Faculty Meeting
April 10, Tuesday	Faculty Assembly Meeting
May 4, Friday	Last Classes, Second Semester
May 7, Monday, to May 12, Saturday, incl.	Final Examinations, Second Semester
May 14, Monday	Grade Reports for Graduating Seniors and Graduate Students Due in Deans' Offices
May 15, Tuesday	Deans' Reports of Graduates Due in Office of Admissions and Records
May 19, Saturday	Alumni Day
May 20, Sunday	Commencement

**WEST VIRGINIA
BOARD OF REGENTS**

1316 Charleston National Plaza
Charleston, W. Va. 25301

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Dr. Forrest L. Blair, *Vice-President*, Walker
Earle T. Andrews, *Secretary*, Berkeley Springs
John E. Amos, Charleston
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Okey L. Patteson, Mount Hope
Frederick P. Stamp, Jr., Wheeling
Daniel B. Taylor, *ex officio*, Charleston
Dr. Prince B. Woodard, *Chancellor*, Charleston

**WEST VIRGINIA UNIVERSITY
ADVISORY BOARD**

Office of the President
Morgantown, W. Va. 26506

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Robert E. Mentzer, Weirton
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Dr. A. J. Villani, Welch
Harold J. Shamberger, *Secretary*

It is the policy of West Virginia University to provide equal opportunities to all prospective and current members of the student body, faculty, and staff solely on the basis of individual qualifications and merit without regard to race, sex, religion, age, or national origin.

The University also neither affiliates with nor grants recognition to any individual, group, or organization having policies that discriminate on the basis of race, sex, religion, age, or national origin.

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WEST VIRGINIA UNIVERSITY

Office of the President

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Vice-President—Administration and Finance, Harry B. Heflin, Ph.D.
Provost—Health Sciences, Charles E. Andrews, M.D.
Provost—Instruction, Jay Barton, II, Ph.D.
Provost—Off-Campus Education, Ralph E. Nelson, Ph.D.
Provost—Planning, Raymond M. Haas, D.B.A.
Provost—Research and Graduate Studies, Ray Koppelman, Ph.D.
Executive Assistant to the President, Harold J. Shamberger, M.P.A.
Assistant to the President, Londo H. Brown, LL.B.
Assistant to the President—Communications, Harry W. Ernst, M.S.J.
Assistant to the President—Grants and Contracts, George E. Kirk, M.B.A.
Assistant to the President—Rapid Transit System, Samy E. G. Elias, Ph.D.
Administrative Assistant, Mary A. McDaniel, M.A.
Administrative Assistant, Wilma G. Starkey
Executive Secretary to the President, Edith I. Kelley
Internal Auditor, S. A. Cunningham, B.S., C.P.A.
Ombudsman, Stacy L. Groscup, B.D.

Deans

Admissions and Records, John D. Brisbane, Ed.D.
Agriculture and Forestry/Agricultural Experiment Station, Robert S. Dunbar, Jr., Ph.D., Dean and Director
Appalachian Center, B. L. Coffindaffer, Ph.D., Dean and Director
Continuing Education and Extended Credit Programs, Edsel Gainer, M.S., Director
Cooperative Extension Service, Ronald L. Stump, M.S., Associate Director
Arts and Sciences, John C. Wright, Ph.D.
Bureau for Government Research, Orrin B. Conaway, Jr., Ph.D., Director
Business and Economics, Jack T. Turner, D.B.A.
Bureau of Business Research, James H. Thompson, Ph.D., Director
Creative Arts Center, Richard E. Duncan, Ph.D., Dean and Director
Dentistry, W. Robert Biddington, D.D.S.
Engineering, Chester A. Arents, M.E., Dean and Director
Engineering Experiment Station, William R. Boyle, Ph.D., Assistant Director
Graduate, Stanley Wearden, Ph.D.
Human Resources and Education, William G. Monahan, Ed.D.

Journalism, Guy H. Stewart, Ph.D.

Law, Willard D. Lorensen, J.D.

Medicine, Frank W. McKee, M.D.

Mines, Jay Hilary Kelley, Ph.D.

Coal Research Bureau, Joseph W. Leonard, M.S., Director

Nursing, Lorita D. Jenab, Ed.D.

Pharmacy, Raphael O. Bachmann, Ph.D.

Physical Education, C. Peter Yost, Ph.D.

Potomac State College, Harold C. Doster, Ph.D.

Social Work, Leon H. Ginsberg, Ph.D.

Student Educational Services, Joseph C. Gluck, B.D.

Counseling Service, James F. Carruth, Ph.D., Director

Financial Aids, Neil A. Bolyard, M.A., Director

Foreign Students, Nelson R. Bickley, M.A., Director

Health Service, Charles E. Andrews, M.D., Acting Director

Placement Service, M. Cornelia Ladwig, Ph.D., Director

Residence Halls Programs, Betty Boyd, A.B., Director

Directors

Air Force Aerospace Studies, Col. Elbert L. Kidd, M.S.

Alumni Association, David W. Jacobs, A.B.

Book Store, Ruth E. Robinson, A.M.

Budget Office, Richard M. Gardner, M.B.A.

Comptroller, William H. McMillion, M.S.

Computer Center, Wayne A. Muth, Ph.D.

Development Office, Donovan H. Bond, M.A.

Housing, Robert A. Robards, B.S.

Intercollegiate Athletics, Leland E. Byrd, Ed.D.

International Programs, Newton M. Baughman, Ph.D.

Libraries, Robert F. Munn, Ph.D.

Military Science, Col. Duquesne A. Wolf, M.S.

Mountainlair, Edwin W. Reynolds, M.A.

Personnel, S. Thomas Serpento, M.A.

Physical Plant, Vergil B. Clark, M.S.

Purchasing and Inventory, James C. Reed

Radio, Television and Motion Pictures, C. Gregory Van Camp,
M.S.J.

Regional Research Institute, William H. Miernyk, Ph.D.

Security Police, Kenneth B. Johnson

University Hospital, Eugene L. Staples, M.H.A.

Nursing Service, Audrey E. Windemuth, M.N.A.

University Relations, Harry W. Ernst, M.S.J.

Publications, John Luchok, B.S.J., University Editor

PART 1

GENERAL INFORMATION

West Virginia University, which was founded on February 7, 1867, combines into a single institution the functions of a state university and a state land-grant university—functions assigned to two or more institutions in many states. Thus the range and variety of instructional, research, and off-campus programs at WVU are greater than at many institutions its size.

The primary mission of the University within the West Virginia system of higher education is to serve as the center for graduate and professional training, research, and extension education. WVU's total statewide enrollment was more than 20,000 persons for the First Semester of the 1971-72 academic year, including 3,408 graduate and professional students at Morgantown, 766 freshmen and sophomores at Potomac State College in Keyser, and 2,013 persons in extension credit classes throughout the state.

The major academic divisions of the University are: College of Agriculture and Forestry; Creative Arts Center; School of Dentistry; College of Engineering; Graduate School; College of Human Resources and Education; School of Journalism; College of Law; School of Medicine; Division of Military Science (Army ROTC) and Division of Air Force Aerospace Studies (ROTC); School of Mines; School of Nursing; School of Pharmacy; School of Physical Education; and School of Social Work.

West Virginia University is a member of the North Central Association of Colleges and Secondary Schools. All of the Uni-

GRADUATE SCHOOL EXECUTIVE COMMITTEE

Ray Koppelman, Ph.D., (ex officio), *Provost—Research and Graduate Studies*

Stanley Wearden, Ph.D., (ex officio), *Dean (Chairman)*

Howard W. Butler, Ph.D., *Professor of Mechanical Engineering (1972)*

Leo Fishman, Ph.D., *Professor of Economics and Finance (1972)*

William W. Fleming, Ph.D., *Professor of Pharmacology (1974)*

Donald J. Horvath, Ph.D., *Professor of Animal Nutrition and Physiology (1973)*

B. Jack McCormick, Ph.D., *Associate Professor of Chemistry (1974)*

George E. Schafer, Ph.D., *Professor of Music (1973)*

versity's educational programs are fully accredited by the North Central Association and by the appropriate accreditation agencies for the professional schools.

The academic year is divided into two semesters of approximately seventeen weeks each and a summer session of nine weeks.

West Virginia University's growth in physical facilities since 1958 has been equaled by few universities of its size in the nation. During that time more than \$100 million in new buildings and facilities either have been built or are under construction in Morgantown.

They include a \$7.9 million Creative Arts Center; engineering and agriculture buildings costing \$10 million; the \$27.5 million Medical Center complex; \$18.4 million in residence halls and apartments; a \$5.4 million forestry building and tower; \$4 million in chemistry facilities; a \$10.5 million Coliseum; and the \$6.7 million campus activities center (Mountainlair) with its adjoining plaza and parking garage. A College of Law building and a Library-Computer Center are now scheduled for construction near the Medical Center, as well as an addition to the Creative Arts Center.

The campuses in Morgantown contain 57 buildings on 610 acres. A University-operated, inter-campus bus system connects the campuses and an internationally unique Personal Rapid Transit System—featuring small automated cars operated by a system of computers on elevated guideways—is now under construction between downtown Morgantown and the campuses. The system is being built by the U. S. Department of Transportation as a research and demonstration project.

WVU operates nine experiment farms in Hardy, Jefferson, Mason, Monongalia, Preston, Randolph, and Wetzel counties; a biological station near Terra Alta; a geology camp near White Sulphur Springs; and State 4-H facilities at Jackson's Mill. The University also is involved in an agricultural education and research program in East Africa, which is financed by the U. S. Agency for International Development, and a federally-funded Regional Medical Program serving West Virginia.

WVU's Center for Appalachian Studies and Development, organized in 1963, has pioneered nationally in broadening the role of the federally funded Cooperative Extension Service from strictly agricultural education to Community development. The Appalachian Center takes expertise to the people through six area centers and offices in all of West Virginia's 55 counties.

GOVERNMENT AND ORGANIZATION OF WVU

The West Virginia Board of Regents is vested by law with authority for the control and management of the University and all other state institutions of higher education. Serving on the Board are nine members appointed by the Governor with advice

and consent of the Senate and the State Superintendent of Schools, an ex officio member. The seven members of the West Virginia University Advisory Board are appointed by the Board of Regents to serve as consultants to the President.

The President, who is appointed by the Board of Regents, is the chief executive officer of the University as well as its principal academic officer, a role which his position as presiding officer of the University Senate symbolizes. The president's office staff includes the vice-president, provosts, and the assistants to the president.

The University Senate was established in November, 1945, as the vehicle for faculty participation in the government of the University. It is a legislative body with original jurisdiction over all matters of academic interest and educational policy that concern the entire University or affect more than one college, school, or division. The Senate's decisions are subject to review and approval by the President and the Board of Regents. The Senate includes the President of the University as chairman, Provosts, Academic Deans, five administrative officers appointed by the President, and Senators elected by members of the University Faculty Assembly to represent their college and other constituencies. Each constituency is entitled to one Senator for each twenty constituents who are members of the University Faculty Assembly. The Senate normally meets once a month.

The University Faculty Assembly includes the President of the University as presiding officer, Provosts, Academic Deans, Professors, Associate Professors, Assistant Professors, and Instructors holding appointments on a full-time basis, and such other persons engaged in full-time professional activities responsive to the academic obligations of the University. The Faculty Assembly normally meets twice a year.

West Virginia University also has a tradition of strong *student government* that touches all aspects of student life and represents student opinion to the administration and faculty. Student administration has three main branches: Executive, including the student body president and vice-president who are elected every spring; Legislative; and the Academic Study Forum. A total of 95 students also serve on 39 University committees including the Committee on Student Discipline (two student members and three faculty members) and the Mountainlair Advisory Council (four students and four faculty members).

MORGANTOWN AREA

West Virginia University is located in the heart of the Appalachian Mountains, which are among the oldest and contain the world's greatest hardwood forest that begins in Southern West Virginia. Morgantown has a population of 29,000 persons; Monongalia County, 64,000 persons. Monongalia is one of the largest deep-mine coal-producing counties in the nation, with production exceeding 10 million tons annually. WVU is the largest single employer.

Located on the east bank of the Monongahela River, which flows north to Pittsburgh, Morgantown is situated on rugged terrain of the Appalachian Highlands. The altitude of the city varies from 800 to 1,150 feet above sea level, while the surrounding hills rise eastward to Chestnut Ridge which has altitudes of 2,600 feet just 10 miles from the city.

The area's temperate climate is marked by four distinct seasons of about equal length. Morgantown's valley location allows it to usually escape the extremes of winter—downtown snowfall averages only 25 inches annually and cold waves, which average about three a year, are blunted by the hilly terrain. Heavy winter clothing isn't usually needed until after Thanksgiving.

Morgantown is served by bus and by Allegheny Airlines.

U. S. Routes 19 and 119 pass through Morgantown in the north-south direction. Pittsburgh is 70 miles north. The cities of Charleston, W. Va., Washington, Baltimore, Cleveland, and Columbus, Ohio, all lie from 200 to 220 miles distant. A north-south interstate highway, I-79, is being constructed to pass just west of Morgantown.

Because of WVU's intellectual resources, the Morgantown area is becoming the major research center in the Appalachian region. Four federal agencies have located research facilities in the area—the Department of Health, Education, and Welfare (the Appalachian Center for Occupational Safety and Health), the Forest Service (the Forestry Sciences Laboratory), the Morgantown Energy Research Center of the U. S. Bureau of Mines, and the Soil Conservation Service (West Virginia headquarters). The American Association of Cost Engineers also recently moved its national headquarters to Morgantown primarily because of WVU's computer and other resources.

Two new installations add to the area's variety. They are the Robert F. Kennedy Youth Center, a model rehabilitation facility for youths who violate federal laws, and an earth tracking station of the Communications Satellite Corporation in neighboring Preston County (its 97-foot antenna sends and receives world-wide telephone and other communications from satellites in outer space).



Towers Residence Halls—Evansdale Campus

LIVING ACCOMMODATIONS

The University Housing Office, 440 Medical Center Drive (phone 304/293-3621), is a source of information concerning both University and privately owned off-campus housing. The University maintains seven residence halls, two for men and five for women. It also operates several hundred furnished and unfurnished apartments for married students, graduate students, faculty, and staff. There are other living accommodations in converted residences, in apartments, and in private homes, of which a few also board students.

WVU LIBRARY SYSTEM

The West Virginia University Libraries contain over one million items including approximately 685,000 physical volumes, 33,000 reels of microfilm, and 380,000 microcards. Some 30,000 volumes are added each year, and 6,000 periodical titles are currently received.

The collections in the biological sciences, chemistry, engineering, sociology, Africana, the Southern Appalachians, and West Virginia history are especially strong. Facilities for research in West Virginia and regional history are centered in the West Virginia Collection. In addition to an extensive collection of books, periodicals, and maps, the Collection contains over three million manuscripts. These, together with court records from many counties, are invaluable sources for the study of all aspects of West Virginia history.

The Rare Book Room contains an unusually fine collection of first and limited editions, including the four Shakespeare folios, and the first editions of many of the work of Dickens, Scott, and Clemens.

The Agriculture-Engineering Library, located on the second floor of the Engineering Sciences Building on the Evansdale Campus, consists of approximately 56,000 volumes. A public card catalog is maintained. In addition, cards for titles in the library are filed in the central Library catalog and are marked "Ag-Eng."

The Physical Sciences Library of approximately 20,000 volumes is located in the Chemistry Research Laboratory. The 83,000-volume Law Library is located on the second floor of the Law Building. The Mathematics Library in the Old Music Building has approximately 7,000 volumes.

The Medical Center Library is on the second floor of the Basic Sciences Building in the Medical Center. It contains some 86,000 volumes with a complete public catalog. Author cards for titles in the Medical Center Library appear in the central Library catalog. A Music Library of approximately 5,000 volumes and an equal number of scores is located in the Creative Arts Center.

COMPUTER CENTER

The Computer Center is located at 837 Chestnut Ridge Road, directly across from the Medical Center heating plant. The equipment configuration includes an IBM 360/75 large scale general purpose electronic digital computer with 512K bytes of high speed 4-way interleaved core memory and 1024K bytes of low speed core storage; two 3.9 million byte magnetic drums and fourteen removable 29 million byte magnetic disks; one 7-track and two 9-track magnetic tape drives; two 1,100 lines-per minute chain drive printers; one card read/punch device rated to read 1,000 cards per minute and punch 300 cards per minute; and teleprocessing control devices to simultaneously support the following remote terminals: one IBM 1130 computer (located in the Administration Building); one UCC COPE .38 Terminal (located in Room 711, Engineering Sciences Building); one IBM 2780 Data Processing Terminal (on a dial-up line); eight CRT display terminals; and fifteen typewriter terminals. Services include:

Seminars—conducted regularly on such topics as computer fundamentals, languages, and using the library programs. Special requests for seminars may be made through the Academic Services section. Scheduled seminars are announced in the Computer Center newsletter.

Library of General Purpose Programs—includes the WVU Statistical Monitor (SOS), the North Carolina State Statistical Analysis System (SAS), the BMD statistical package developed at UCLA, the IBM Scientific Subroutine Package, and many other programs and subprograms to support the research efforts of users. User documentation for these programs may be obtained through the Information Controller at the Computer Center. Abstracts of all systems, programs, and subprograms also are available .

Consulting—available to users through the Academic Services section. Program consultants are available at the center during normal working hours. A statistical consultant is available at the Computer Center by appointment during normal working hours. These consultants are qualified to answer questions about system requirements, language specifications, Computer Center procedures, and general programming and data processing considerations. In addition, they each have special areas of interest and competence that may be relevant to particular user needs.

Keypunching—of programs and data for faculty, graduate students, and staff is provided by a keypunch section. All work is verified by an independent operator to minimize errors. It is recommended that all voluminous keypunching be submitted to the keypunch section in the Administration Building.

Test Scoring—by optical page reader is available to all faculty members. This facility includes the capability of summarizing test results by class section and across all sections, of using more than one test key, and of performing a simple item analysis of the test.

Programming—is not generally done by Computer Center personnel for specific users. It is a full-time job to develop and maintain a general-purpose program library for all users. However, if a user has a programming need of sufficient generality, it will be considered by the Academic Services programming staff. Alternatively, the Computer Center Information Controller maintains a list of available student programmers. Users are expected to make their own arrangements with student programmers.

VETERANS

Information regarding educational opportunities made possible at the University through provisions of the Veterans Readjustment Benefits Act of 1966—G.I. Bill (Public Law 358), the Vocational Rehabilitation Program of the Veterans Administration (Public Law 16), and the War Orphan's Educational Assistance Act of 1956 (Public Law 634) may be obtained from the Veterans Counselor by personal conference at his office in Mountainlair or by mail. An amendment to Public Law 634, passed by Congress in the summer of 1964, provides benefits to many dependents of 100 per cent disabled veterans.

FOREIGN STUDENTS

All new foreign students must contact the Foreign Student Office in Elizabeth Moore Hall when they first arrive. The Foreign Student Adviser is available for guidance and counseling. Foreign students are encouraged to join the International Students' Association, an organization of foreign and American students interested in international relations. They are also encouraged to join

their particular nationality organizations. The Host Family Program provides foreign students an opportunity to meet and become acquainted with American families and visit in their homes.

All inquiries and applications from foreign students must be sent to the Dean of Admissions and Records. The Test of English As a Foreign Language (TOEFL) must be taken by all foreign students before they can be admitted to West Virginia University.

STUDENT FINANCIAL AIDS

Information and guidance on loans for graduate students is available in the Financial Aids Office, Mountainlair.

On-campus employment opportunities can be investigated at both the Financial Aids Office and the University Personnel Office, 511 North High Street.

ASSISTANTSHIPS, FELLOWSHIPS, AND TRAINEESHIPS

West Virginia University annually awards over 500 graduate assistantships supported from State appropriations, federal funds, private grants, and contracts; and about 200 fellowships and traineeships derived from federal programs such as NDEA, NIH, NSF, RSA, VA, etc., and from industrial and other non-public agencies.

Stipends for assistantships are generally stated in terms of 9 or 12 months' appointments for half-time service, i.e. 20 hours service per week in the case of research assistantships, and the assisting with instruction of two courses or the equivalent in the case of teaching assistantships. Most fellowships and traineeships require enrollment for full-time study but no formal teaching or research duties. Tuition and registration fees are generally remitted. Departments may occasionally make appointments for more than or for less than half-time service with proportionately adjusted compensation. In the latter cases, the remission of tuition and registration fees is also reduced proportionately. Assistants giving half-time service are advised to take no more than 12 credit hours in any one semester and some College and Department regulations may be more strict in this regard.

Applications should be made by the first week in March to the Dean of the College concerned (not to the Dean of the Graduate School), the Directors of the Office of Research and Development, Water Research Institute, and the Regional Research Institute; or in the case of Agriculture and Forestry, Arts and Sciences, Engineering, and Medical Sciences, to the Chairman of the Department in which the student's course work will be pursued.

Agriculture and Forestry

Graduate research assistantships at stipends of \$3,000 and \$3,600 for those holding Bachelor and Master Degrees, respectively,

are available on a 12-month basis for half-time service, permitting a maximum of 9 hours per semester and waiving of tuition in Agricultural Biochemistry, Agricultural Engineering, Agronomy and Genetics, Animal and Veterinary Science, and Plant Pathology and Bacteriology. Research assistantships at stipends of \$3,000 are available also in Agricultural Education, Forestry, Horticulture, and Agricultural Economics.

Teaching assistantships at stipends of \$2,400 on a 9-month basis requiring half-time service, permitting a maximum of 9 hours per semester and waiving of tuition, are available in Agricultural Biochemistry, Agricultural Education, Agronomy and Genetics, Animal and Veterinary Science, Forestry, Horticulture, and Plant Pathology and Bacteriology.

Arts and Sciences

Biology—Teaching assistantships up to \$2,400 for 9 months, half-time service, tuition and biology fees exempt. Research fellowships and assistantships with stipends comparable to teaching assistantships.

Chemistry—Teaching, assistantships starting at \$2,600 for 9 months, half-time service, tuition and chemistry fees exempt. Research fellowships and assistantships supported by contracts and grants from government, private and industrial sources. Stipends comparable to teaching assistantships.

English—Teaching assistantships up to \$2,000 for 9 months, half-time service, tuition exempt. After 24 hours of graduate credit, the amount increases.

Foreign Languages—French, German, Spanish—Teaching assistantships beginning at \$2,000 for 9 months, half-time service, tuition exempt.

Geology—United States Steel Foundation Fellowship at \$3,000 for 9 months, tuition exempt. Teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

History—Teaching assistantship, up to \$2,000 for 9 months, half-time service, tuition exempt.

Mathematics—Teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

Philosophy—Assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Physics—Teaching assistantships starting at \$2,400 for 9 months, half-time service, tuition exempt. Research assistantships supported by contracts and grants. Stipends comparable to teaching assistantships.

Political Science—Departmental assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Psychology—Psychometric, laboratory, and teaching assistantships up to \$3,200 for 9 months, half-time service, tuition exempt. Also USPHS and VA Traineeships at standard stipends.

Speech—Teaching assistantships, beginning at \$2,000, half-time service, tuition exempt.

Business and Economics

Business Administration and Economics—Teaching or research assistantship up to \$3,500 for 9 months, half-time service, tuition exempt.

Creative Arts (Art, Drama, Music)

Teaching, research, performance, and technical assistantships up to \$2,500 for 9 months, half-time service, tuition exempt.

Engineering

Teaching fellowships in aerospace, chemical, civil, electrical, industrial, materials science, mechanical, nuclear engineering, and theoretical and applied mechanics, up to \$3,800 for 9 months, half-time service, tuition exempt. Air pollution control, solid waste, water supply and environmental science, graduate traineeships from \$2,400 to \$3,600 for 12 months plus dependency allowance, tuition exempt.

Engineering Experiment Station

Research assistantships in aerospace, materials science, chemical, civil, electrical, industrial, mechanical, mining, nuclear, petroleum, and geological engineering, and theoretical and applied mechanics. Stipends \$200 to \$400 per month for 9 to 12 months, half-time service, tuition exempt.

Human Resources and Education

Research and teaching assistantships up to \$3,000 for 9 months, half-time service, tuition exempt.

Journalism

Teaching assistantships up to \$1,800 for 9 months, one-third time service, tuition exempt.

Medical Science

Support from training, research, and other grants in anatomy, biochemistry, microbiology, pharmacology, and physiology; stipends from \$2,400 to \$2,800 for 12 months. Additional allowances for dependents.

Physical Education and Safety Education

Teaching and research assistantships up to \$2,000 for 9 months, half-time service, tuition exempt.

Regional Research Institute

A limited number of part-time research fellowships are awarded to graduate students who demonstrate a strong aptitude and interest in regionally-oriented basic research in the social sciences. Awards in variable amounts up to \$3,700 for 9 months, tuition exempt.

Social Work

Graduate traineeships for master degree candidates. Stipends up to \$3,000 for 12 months. Tuition paid by student.

West Virginia Center for Appalachian Studies and Development

Office of Research and Development—Research assistantships up to \$2,250 for 9 months and \$3,000 for 12 months, half-time service, tuition exempt.

Water Research Institute—Research assistantships up to \$2,700 for 9 months and \$3,600 for 12 months, half-time service, tuition exempt.

WVU Foundation Doctoral Fellowships

The West Virginia University Foundation, Inc. sponsors a series of three-year fellowships for outstanding entering doctoral students in Graduate School programs. Departments are selected each year to make nominations for these awards to the Dean of the Graduate School. Stipends are \$4,000 for full-time, full-year enrollment or pro-rated at \$333 per month during the 9 months of the regular academic year. Inquire of the Chairman of the Department of the major field as to the availability of such a fellowship in that department. There are now 40 WVU Fellows enrolled, and 20 new fellowships are available in 1972-73. Selections are announced by April 15 and tenures may start with the summer session or the fall semester.

Kent Fellowships

For men and women under 30 with some graduate work preparing for teaching or administration in American colleges and universities. Applications obtainable direct from Danforth Foundation, 222 South Central Avenue, St. Louis, Missouri 63105, for submission by November 17. Stipend up to \$2,800 with dependency and other allowances and renewal possible for a total of three years.

NSF Graduate Traineeships

The National Science Foundation grants the University authority to select a number of trainees for study leading to master's or doctoral degrees in the mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science. Nominees must be U. S. citizens or nationals. Stipend is \$3,000 for a 12-month tenure and there may be opportunity of renewal. Nomination of trainees is by departments and their selections are considered after the grant is awarded in January. This program is being phased out and only vacancies may be filled in 1972-73 and 1973-74.

NSF Graduate Fellowships

Available for U. S. citizens or nationals in the fields of mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science. Stipend is \$3,600 for a 12-month tenure in up to three years. The student applies directly to the Fellowship Office, National Academy of Sciences, National Research Council, 2101 Constitution Avenue, N.W., Washington, D. C. 20418. The student may select his own graduate school, but it is his responsibility to obtain admission. Application deadline is about December 1.

Oak Ridge Fellowships

The opportunity to participate in the Graduate Fellowship Program of the Oak Ridge Institute of Nuclear Studies is open to qualified students in the fields of biology, chemistry, engineering, mathematics, physics, and other scientific fields. When certified by the University and after completion of his course work, the student has the opportunity to conduct research using the facilities of the Oak Ridge National Laboratory and other Oak Ridge facilities. The basic annual stipend is \$3,000 with an allowance of \$500 for each dependent. Tenure is for the last year of course work on-campus and/or the final dissertation year at the Oak Ridge National Laboratory. In some cases, graduate students may be offered the opportunity to acquire research experiences through summer appointments at Oak Ridge National Laboratory prior to the time they are qualified to receive a fellowship.

Public Health Service Predoctoral Fellowships

Available for U.S. citizens or those lawfully admitted to the U.S. for permanent residence having bachelor's degree or equivalent training. Graduate work must be in the basic sciences such as biology, chemistry, physiology, biochemistry, etc. as they relate to problems of health and disease. Among the social sciences,

those areas such as psychology and sociology that relate to the problems of health and disease, and some interdisciplinary fields such as biostatistics, medical economics, cultural anthropology, etc. Stipend is \$2,400 at first year level with \$500 for each qualified dependent and certain travel expenses; up to \$2,800 for candidate in final year of doctorate program. Application by form from Chief, Career Development Review Branch, Division of Research Grants, National Institutes of Health, Bethesda, Maryland 20014.

Under Public Health Service Grants, there are graduate traineeships available which include the fields of air pollution control engineering and other environmental engineering fields. The level of these is from \$3,000 for first-year students to \$3,600 for post-master's students plus \$500 per dependent, certain travel allowances, and tuition exempt. Information on these particular traineeships is available from the Department of Civil Engineering.

U.S. Steel Fellowship in Geology

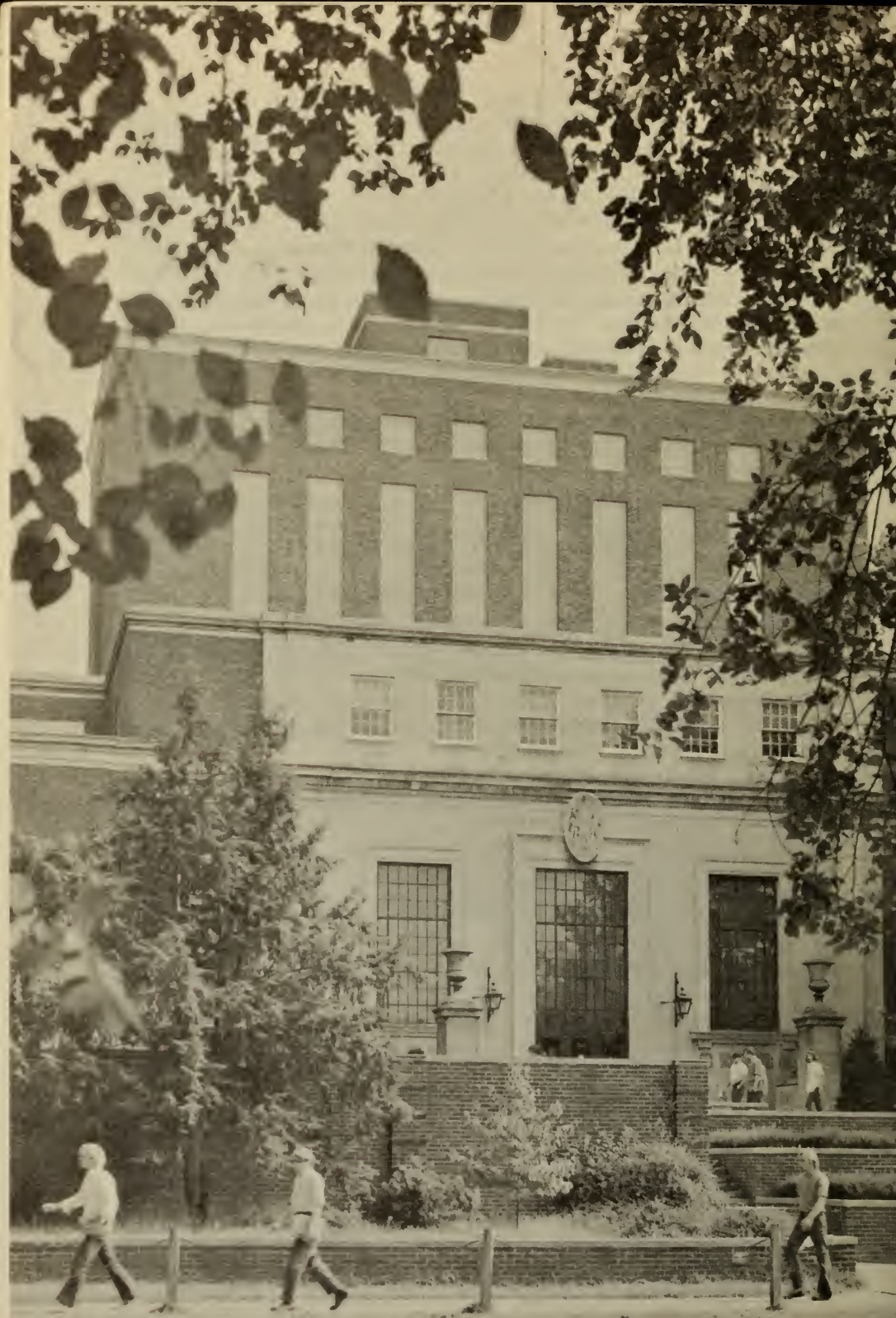
Inquire of Department of Geology.

Additional Reference to Fellowship Opportunities

"A Selected List of Major Fellowship Opportunities and Aids to Advanced Education for United States Citizens" provides excellent short summaries concerning sources of support for graduate study and research. Obtainable from the Fellowship Office, Office of Scientific Personnel, National Research Council, 2010 Constitution Avenue, Washington, D. C. 20418.

Stipend Payment Dates for WVU Foundation, NDEA, and NSF Trainees and Fellows

The start of entitlement periods under these awards is usually September 1 of each year. Invoices for payments are prepared in the Office of the Graduate School each month between the 10th and the 15th for entitlements earned during that month. Checks are normally available at the Office of the Graduate School for the students on the first day of the next month. Students to receive stipends under these programs must arrange their finances accordingly for their needs from the start of the fall semester to October 1.



University Library

PART 2

ACADEMIC INFORMATION

Established in 1930, the Graduate School, as distinct from other colleges and schools, is University-wide, drawing together all the faculties and students of the University concerned with graduate study, and empowered to establish: policies and regulations covering the introduction of degree programs; degree, curricular, thesis, and dissertation requirements; standards of student scholarship; residency rules, etc., which take precedence over the policies and rules of particular colleges, schools, and departments.

All decisions on major policies and regulations affecting graduate study and the introduction of new degree programs are based on recommendations made by the Graduate Faculty, after study and advice by the Executive Committee of the Graduate Faculty and the Dean of the Graduate School. Responsibility for determining graduate faculty membership and associate membership is essentially in the hands of the Executive Committee, acting on recommendation from the staff member's department chairman. The Executive Committee consists of nine members, the Provost—Research and Graduate Studies, the Dean of the Graduate School, and the Dean of the Kanawha Valley Graduate Center, ex officio, and six graduate faculty members elected at large by the graduate faculty for staggered terms of three years. The Executive Committee normally meets once a month and calls meetings for the Graduate Faculty twice during the academic year.

In practice, much of the day-to-day administration of graduate study is conducted by the departmental chairman or graduate advisers responsible for the particular programs. At the University level, responsibility for administration of the graduate faculty's policies and regulations, resolving problems of interpretation of these rules, keeping student records, and preparing graduation lists is vested in the first instance in the Dean of the Graduate School (Graduate School Office, Room 104, Oglebay Hall).

STUDENT CONDUCT

It is expected that students will come to the University with an earnest purpose to obtain an education and to apply them-

Non-academic policies and regulations affecting students are summarized in the *Student Handbook*. Every student is urged to obtain a copy of the *Handbook* from the Office of Student Educational Services, 109 Martin Hall.

selves to that end. It is therefore expected that students will so conduct themselves as good citizens both within and without the University. To this end it is expected that they will conform to rules and regulations governing conduct and the use of facilities on the campus and that they will set for themselves a standard of personal conduct which will conform to the general community morals with respect to honesty, integrity, and respect for the property and rights of others. It is therefore University policy that the student is required to conform to rules, regulations, laws and ordinances governing conduct as may have been promulgated by state and local governing bodies as well as the West Virginia Board of Regents.

It is expected, furthermore, that students will observe rules and regulations promulgated by the University for the purpose of insuring the peaceful and efficient conduct of the academic affairs of the University. These rules will govern conduct in facilities, the classrooms, and other areas of contact.

In addition to the foregoing, the University has promulgated certain rules and regulations covering cheating and the prosecution of cases involving violation of those rules. Reference is made to the *Undergraduate Catalog* and the *Student Handbook* for specific exposition of those rules and they are made applicable to graduate students as if fully rewritten herein.

ADMISSIONS

General

Prospective graduate students are strongly urged to initiate their admission applications as early as possible. March application for September admission is reasonable procedure.

Applications for admission to the Graduate School must be made on standard forms obtainable from the Office of Admissions and Records. Applications must be submitted to the Office of Admissions and Records and *not* to the Office of the Graduate School. The completed application forms must be accompanied by payment of a non-refundable special service fee of \$10.00. The applicant must at the same time request the registrar or records office of the college of his baccalaureate degree to send an official transcript of his record directly to the Office of Admissions and Records. The applications and transcript should be received at least one month in advance of registration.

Any student with a bachelor's degree who wishes to enroll in a 200-, 300-, or 400-level course who has not been formally admitted to a second bachelor's degree program must first be admitted to the Graduate School.

If the student meets the minimum admission requirements of the Graduate School, a copy of his application is forwarded to the department of his major interest. An applicant must be approved

by the department of his major interest before he can be officially admitted by the Office of Admissions and Records. The Office of Admissions and Records will notify the applicant of the actions taken. Completed admissions may be in one of three categories: 1. *Regular Graduate Student*—one who is approved for a degree program, 2. *Probationary Graduate Student*—one who does not meet the grade-point average or course requirements for Regular Graduate Students, or 3. *Special Graduate Student*—one who is not pursuing a degree program.

A temporary incomplete type of admission known as *provisional admission* is sometimes granted in exceptional instances of late application to permit a student's records to be assembled and evaluated. It is always temporary and represents no other commitment to the student whose responsibility it is to provide complete official transcripts of all previous college work within the semester of enrollment. Completed admission is not official until a letter designating acceptance as a Regular, Probationary, or Special Graduate Student is furnished the applicant by the Office of Admissions and Records.

Admission As a Regular Graduate Student and Maintenance of Good Standing. An applicant may be admitted as a Regular Graduate Student if he has a baccalaureate degree from an accredited college or university, a 2.50 or higher overall undergraduate grade-point average ($A=4$), and the approval of the department in which he proposes to take his major work. Applicants having received a masters degree from an accredited college or university may be admitted as Regular Graduate Students without regard to cumulative grade-point average.

Regular Graduate Students shall be reclassified as *Probationary Graduate Students* if their cumulative grade-point average falls below 2.75. Such students must remove the deficiency in the next semester of enrollment. If this requirement is not met, the student shall not be permitted to enroll further in the Graduate School in the same program.

Admission As a Probationary Graduate Student. An applicant may be admitted as a Probationary Graduate Student if he has a baccalaureate degree from an accredited college or university, a 2.25 or higher overall undergraduate grade-point average ($A=4$), and the approval of the department in which he proposes to take his major work. In order to remove his probation and be accepted as a Regular Graduate Student the Probationary Graduate Student must have earned a 2.75 or higher overall grade-point average at the end of the semester in which he completes the 9th hour of graduate course work at WVU. If the required 2.75 or higher average is not attained at that time, the student shall not be permitted to enroll further in the Graduate School in the same program.

Admission As a Special Graduate Student. This category of admission is only for applicants who are not seeking a degree and

are unlikely to want to use the work towards a degree in the future. Such an applicant may be admitted as Special Graduate Student regardless of undergraduate grade-point average if he has a baccalaureate degree from an accredited college or university and approval of a department offering graduate courses. Work taken as a Special Graduate Student will not normally be considered at any time for approval as credit toward a graduate degree. Under no conditions will more than 9 hours be considered for such approval by the Dean of the Graduate School. Only petitions of students entering with at least the minimum 2.25 undergraduate grade-point average required of Probationary Graduate Students will be considered.

General Regulations

Nothing in the foregoing prevents any department from establishing additional higher admission, good standing, or graduation requirements but a graduate grade-point average of at least 2.75 will be required for graduation from WVU with a graduate degree.

All graduate students are further classified as full-time or part-time students. A full-time student is one who is registered for 9 to 15 semester hours of work during a semester of the regular academic year and for 6 to 12 hours during a 9-week summer session, and for 3 to 6 hours during a 4½-week summer term. Enrollment in four 3-hour courses running the full 9 weeks will be permitted, **or** in two 3-hour courses in each 4½-week term. Enrollment in two 3-hour courses running for one term of 4½ weeks plus any overlapping course running for the full 9-week session will **not** be permitted. Pro-rated 9-week course credit hours plus 4½-week course credit hours must not total more than 6 hours in either term.

Graduate Record and Other Examinations

Certain programs in the College of Human Resources and Education and in some departments of other WVU colleges require GRE scores from all applicants for admission as graduate students. Some departments require scores **both** from the aptitude and the appropriate advanced test before making a decision on the admission application. Some departments require other tests, such as the Miller's Analogy.

Students should arrange to take the tests required by the department of their prospective major (see Part IV) prior to the graduate registration at the University. If Graduate Record Examinations are required, the student should request the Educational Testing Service to forward their scores to the WVU department concerned.

Those planning to take the GRE must mail completed forms so as to reach the Educational Testing Service, Princeton, New Jersey, at least eighteen days prior to the date of the examina-

tion. The forms and examination dates are a part of the GRE information packet available at the WVU Graduate School Office or at other college centers throughout the country. The fee for the aptitude examination is \$8.00; for an advanced examination \$9.00, and for both examinations, if taken on the same day, \$15.00.

Foreign Students

All applications for admission from students in whose baccalaureate college English was not the official language of instruction must take "The Test of English As a Foreign Language (TOEFL)." Such students must submit satisfactory TOEFL scores along with their admission forms to the Office of Admissions and Records at least four months in advance of the proposed date of entry. Information on location of testing centers, dates of testing, and application forms should be obtained from TOEFL Educational Testing Service, Princeton, N. J. 08540 USA.

Petitions by Seniors for Graduate Credit

Seniors in the colleges of WVU and in colleges where WVU offers graduate courses by extension who are within 12 semester hours of graduation may, with the prior approval of the Dean of the Graduate School on special senior petition forms, enroll for graduate courses for which they may receive graduate credit after obtaining the baccalaureate and after being admitted to the Graduate School. The student must not receive undergraduate credit for such courses, and in every case the petition must have been approved before or at the time of enrolling for the course or courses. The maximum amount of graduate credit permitted under this regulation is 15 hours. Combined graduate and undergraduate credit must not exceed 18 hours in one semester or 12 hours in a 9-week summer session (see last paragraph of General Regulations on page 26).

THE ADVISER

Each department or other academic unit through which graduate degree programs are administered has one or more graduate advisers who are members of the graduate faculty. Every graduate student is assigned to such an adviser who arranges a specific cohesive, unified, continuous program of study with the student as early as possible before or after his first enrollment. The program is subject to approval by the Dean of the Graduate School and made a part of the student's records. The general departmental program adviser, usually the department chairman rather than the dissertation chairman or research adviser, will preside at the student's qualifying and final examinations.

REGISTRATION REQUIREMENT

Each graduate student must be registered during the semester or session in which he takes the final examination. This requirement may be met by paying the "fee for examination of a candidate for a graduate degree" at the Comptroller's Office prior to the final examination. A bill slip must first be obtained from the Office of Admissions and Records in order to make this payment to the Comptroller.

CANDIDACY

Admission to candidacy for any graduate degree is an additional requirement over and above admission to the Graduate School and admission to a graduate program in a particular department, school, or college. A candidate for a graduate degree is a student who has been officially admitted to the Graduate School and to a graduate program and has satisfactorily completed a suitable period of graduate work in residence as a regular graduate student in which ability to do work of graduate caliber is demonstrated to the satisfaction of his adviser and graduate committee. In doctoral programs and in some master's programs it is established by successful completion of a departmental qualifying, comprehensive, or candidacy examination as further explained in the following pages under requirements for the doctor's degree, and in Part 4 of this Catalog.

CREDIT LIMITATIONS

General

Credit toward a graduate degree may be obtained only for courses listed in this Catalog and numbered 200-499 in which the grade earned is A, B, C, or S. No courses in which the grade earned is F, D, or U can be counted toward a graduate degree. No residence credit will be allowed for special field assignments or other work taken off the WVU campus without prior approval by the Dean of the Graduate School. No more than 40 per cent of 200-level course credits can be counted toward meeting requirements of any graduate degree.

No more than 15 hours of graduate courses in any one semester may be carried by a student. For credit limitations in summer enrollments see last paragraph of General Regulations section on page 26.

Transfer Credit

The Graduate School requirement for the master's degree at WVU consists of earning no fewer than 30 hours of graduate credit including at least 18 hours taken at WVU of which 15 hours are taken in residence. Approval in writing from the Dean of

the Graduate School must be secured in **advance** to take graduate courses offered elsewhere. Graduate credits so accepted must meet requirements for a continuous and unified program of graduate study. They will reduce correspondingly the number of hours of extension graduate credits which may be accepted toward meeting the requirements for the master's degree.

Extension Credit

No credits earned by extension prior to admission to the Graduate School and acceptance to a degree program of graduate study may be counted toward the master's degree except under the senior petition regulation. No more than 15 hours of extension credit may be counted toward the master's degree.

For majors in the Division of Education of the College of Human Resources and Education no more than 9 hours in extension may be obtained before the student completes at least 6 hours in residence on the campus. Full-time in-service teachers may obtain no more than 9 semester hours of credit toward the master's degree in any one academic year. The maximum amount of extension graduate credit that may be received in any one field is 9 semester hours.

Employed Graduate Students

Graduate students will be required by their advisers to limit their credit loads in proportion to the outside service rendered and the time available for graduate study. In general, persons in full-time service to the University, or other employer, will be advised to enroll for no more than 6 hours of work in any one semester and those in half-time service for no more than 12 hours. Maximum credit loads may be less for employed graduate students in some academic colleges and departments.

Maximum Time for Completion

Completion of requirements for any graduate degree must be accomplished within a period of 7 years. For a master's degree the period starts at the initial enrollment for a graduate course after the bachelor's degree is conferred. The same is true for a doctoral degree, although when there is an intervening award of a master's degree the seven-year period for completion of the doctorate starts at the initial enrollment for a graduate course after the master's degree is conferred. Credits lost at the beginning of a graduate program under this regulation will not usually be considered for revalidation and then only upon formal petition to the Dean of the Graduate School by the student's graduate adviser or committee chairman showing a completion program which the student must meet.

SCHOLARSHIP

To be in good standing, a graduate student must maintain a cumulative graduate course grade-point average of 2.75. A student whose grade-point average falls below 2.75 after the first 9 hours will be placed on probation and required to remove the deficiency during the next semester for which he enrolls. If he fails to do so, he shall not be permitted to continue in the Graduate School. A student who fails one-half or more of the work for which he is enrolled during any semester or summer session will be suspended. This regulation is a minimum standard for the Graduate School and the higher scholarship requirements that most departments have must also be met. A student who has not been accepted in one of the graduate student categories by the department of his choice may not enroll in courses. If he enrolls in such courses, his enrollment may be withdrawn. Credit hours for courses in which the grade is lower than "C" will not count toward satisfying graduate degree requirements.

GRADING

- A—excellent (given only to students of superior ability and attainment)
- B—good (given only to students who are well above average, but not in the highest group)
- C—fair (average students)
- D—poor but passing (cannot be counted for graduate degree credit)
- F—failure
- I—incomplete
- W—withdrawal prior to the end of the fifth week of a semester or withdrawal doing satisfactory work thereafter
- WU—withdrawal doing unsatisfactory work (after the fifth week of a semester)
- X—auditor, no grade and no credit
- CR—credit but no grade

Certain Approved Graduate Courses

- S—Satisfactory
- U—Unsatisfactory (Equivalent to F)

THESES AND DISSERTATIONS

These shall be presented to the student's departmental graduate adviser or committee chairman at least one month for masters candidates and two months for doctoral candidates before the end of the semester or summer session in which completion of all requirements is expected. The form prescribed under the Graduate School "Regulations Governing the Preparation of Dissertations and Theses" must be followed with the guidance of the student's

graduate adviser or chairman of the student's graduate committee. In order for the manuscript to be approved there shall be no more than one unfavorable vote among members of the student's committee. Two accepted copies in approved typewritten form (problem reports and thesis in bound form and dissertations unbound) shall be delivered to the Office of the Graduate School at least one week before the close of the period in which the degree is expected to be completed (one week before the end of the summer session, one week before the end of the final examination period at the end of the first semester, or one week before Commencement Day at the end of the second semester). Additional regulations are described under specific degree requirements in the following pages, and in the "Information and Check List for Masters Candidates" and a corresponding leaflet for Doctoral Candidates, available at the Office of the Graduate School. Problem reports are deposited with the major department in the form required.

The WVU Office of Publications provides service to graduate students in the preparation of multiple copies of master's theses and doctoral dissertations. Following are some of the guidelines concerning the services offered:

1. Students must furnish a neatly typewritten manuscript of the text with all pages numbered and collated in conformity with the regulations of the Graduate School. The use of carbon ribbons on typewriters will help produce neater copies of the thesis.

2. The Office of Publications usually cannot reproduce over-size scores, maps, charts, or other illustrations larger than page size but it will give advice to students concerning the presentation of these materials and furnish names of businesses that can handle the work.

3. The typed pages must be delivered to Room 113, Communications Building, Patteson Drive, or to the Mountainlair Book Store, along with the required amount of 16-pound or heavier, 100 per cent rag or cotton content, white bond paper. The student must personally provide this paper to the Office of Publications. It can be obtained at the WVU Book Store and other local office supply and book stores.

4. Charges will be the published rates which may be obtained at the copy centers.

5. Normal lead time for completion of the work is three weeks and work cannot be accepted requiring earlier delivery. Students who desire faster service will be referred to shops that may be able to provide it.

6. Delivery cannot be made except upon payment in full by cash.

7. The phone numbers to use in making special inquiry concerning this service are 293-5897 (Publications) or 293-4351 (Mountainlair Book Store).

8. The service should be welcomed by graduate students as it increases the possibilities open to them in meeting degree requirements. Spacing of requests over the full semester or summer will be necessary to insure continuance of the service.

FINAL EXAMINATIONS

The final examinations shall not be given until the semester or summer session in which all other requirements for the degree are to be met. In programs requiring a thesis, or dissertation, the final examination must follow committee approval of the manuscript. The student's adviser or committee chairman must notify the Office of the Graduate School in advance of the time, place, and recommended examining committee membership and receive back clearance in the form of the student's "Shuttle Sheet" before the examination can be given. Such notifications of doctoral examinations must be received in the office of the Graduate School at least three weeks in advance of the examination date. All doctoral final oral examinations are open examinations and the lead time is required for public notice to the University community. Examining committees shall be comprised of no fewer than three members for the master's degree and no fewer than five members for the doctor's degree. The chairman and the majority of master's degree committee membership must be members (full) or associate members of the Graduate Faculty and it is customary to have one member from a department other than that of the student's major field.

For doctoral programs both the dissertation and final examination chairmen must be members (full) of the Graduate Faculty as well as the majority of the committee members. Every doctoral committee must include at least one member of a department other than that of the major field of the doctoral program. The student cannot be considered as having satisfactorily passed the final examination if there is more than one unfavorable vote among members of the examining committee. Results of each examination must be reported to the Office of the Graduate School by return of the shuttle sheet within 24 hours of scheduled time regardless of whether or not the examination is held. Re-examination may not be scheduled without approval of the Dean of the Graduate School. No examination is to be given without all committee members present. Additional requirements for research doctorates include acceptance by the Graduate School Office of the dissertation bearing original signatures of at least all but one of the Committee members. As with the final examination, no more than one committee member may dissent in approval of the dissertation for the degree to be recommended.

REQUEST FOR DEGREE

At the time of registration for the semester or the summer session in which all degree requirements are expected to be met, or at the latest within two weeks after such registration, each candidate shall submit a formal request on a special "Application for Graduation and Diploma" form to the Dean of the Graduate School for the conferring of the degree. The candidate must complete all requirements at least one week before the end of that semester or summer session. If the degree is not actually earned during that semester then the student must submit a new "Application for Graduation and Diploma" at the beginning of the term in which he does expect to meet all requirements.

COMMENCEMENT ATTENDANCE

Students graduating as of the close of the second semester are required to participate in the commencement exercises unless excused in writing by the Dean of the Graduate School. Students graduating as of the close of the summer session and as of the close of the first semester are not required to participate in the commencement exercises but are invited to do so. All doctoral graduates as of the close of the first semester or as of the close of the summer session must notify the Office of the Graduate School as to their participation in the commencement exercises so that plans for presentation of diplomas can be made accordingly.

THE DEGREES OF MASTER OF ARTS AND MASTER OF SCIENCE

Requirements

General: The regulations governing admission, registration, establishment of candidacy, scholarship, theses, final examinations, etc. described in the preceding sections must be followed. These are also summarized in the "Information and Check List for Masters Candidates" available at the Office of the Graduate School.

Program: No less than 30 hours of graduate work planned with the student's graduate adviser must be satisfactorily completed within a period of seven years immediately preceding the conferring of the degree. The program must be formulated in writing at the earliest possible date so as to result in a cohesive, unified and continuous plan of study. In degree programs requiring a thesis or problem report, appropriate courses may be taken to cover the research and writing, but no more than 6 hours of credit earned for research or thesis may be counted in meeting course requirements for the degree. In most departments the program consists of certain amounts of work in major and

minor fields. These are described in the departmental programs in Part IV.

Special: Each student, through consultation with his graduate adviser, must meet the special requirements of the faculty of the field in which he pursues his major study, subject to approval of the Dean of the Graduate School.

Degrees

Fields or departments through which these degrees are offered are as follows:

Master of Arts (A.M.) with a major in:

Art	History
Biology	Mathematics
Counseling and Guidance	Philosophy
Drama	Political Science
Economics	Psychology
Education Administration	Reading
Educational Psychology	Secondary Education
Elementary Education	Sociology
English	Spanish
French	Special Education
Geology	Speech
German	

Master of Science (M.S.) with a major in:

Agricultural Biochemistry	Microbiology
Agricultural Economics	(Med. and Agr.)
Agricultural Education	Orthodontics
Agronomy	Pharmaceutical Sciences
Anatomy	Pharmacology
Animal Science	Physical Education
Biochemistry (Medical)	Physics
Biology	Physiology and Biophysics
Chemistry	Plant Pathology
Entomology	Recreation
Family Resources	Rehabilitation Counseling
Genetics	Reproductive Physiology
Geology	Safety Education
Horticulture	Speech Pathology and Audiology
Industrial Relations	Statistics
Mathematics	Wildlife Management
Medical Technology	Wood Science and Technology

Master of Science in the following designated fields:

Aerospace	Chemical
Engineering (M.S.A.E.)	Engineering (M.S.Ch.E.)
Agricultural	Civil Engineering (M.S.C.E.)
Engineering (M.S.Ag.E.)	Electrical Engineering (M.S.E.E.)

Engineering (M.S.E.)	Mechanical
Forestry (M.S.F.)	Engineering (M.S.M.E.)
Industrial Engineering	Engineering of Mines (M.S.E.M.)
(M.S.I.E.)	Petroleum
Journalism (M.S.J.)	Engineering (M.S.Pet.E.)
Mechanics (M.S.T.A.M.)	

Other designated Master's degrees:

Master of Agriculture (M.Ag.)
 Master of Business Administration (M.B.A.)
 Master of Music (M.M.)
 Master of Public Administration (M.P.A.)
 Master of Social Work (M.S.W.)

CERTIFICATE OF ADVANCED STUDY IN EDUCATION

This Certificate is conferred for successful completion of a program through the College of Human Resources and Education for students who have a master's degree.

THE DEGREE OF DOCTOR OF PHILOSOPHY

General Requirements

The regulations governing admission, registration, scholarship, etc., described in the preceding sections must be followed. Students applying for admission to a doctoral program after having received a master's degree at West Virginia University must file a new completed form for admission to the Graduate School with the Office of Admissions and Records. This is to insure the intent and proper records of the student and does not entail an additional admissions special service fee.

Candidacy Requirements

Admission to the Graduate School and enrollment in graduate courses does not of itself imply acceptance of the student as a candidate for a Ph.D., degree. This is only accomplished by (1) satisfactorily passing a comprehensive preliminary or qualifying examination (either oral, or written, or both) and (2) by meeting the Ph.D. language requirements.

(1). *Qualifying Examination:* After a period of residence the student will be admitted to a comprehensive examination in which he must demonstrate a grasp of the important phases and problems of the field of study in which he proposes to major; their relation to other fields of human knowledge and accomplishments; and the ability to employ rationally the instruments of research that have been developed in his major field. The scheduling and results of each such examination must be reported to the Office of the Graduate School (see Final Examination, page 37).

(2). *Foreign Language Examinations*: The foreign language requirement of the Graduate School is that the student demonstrate the ability to read one foreign language in a satisfactory manner. This may be any language in which there exists a significant literature in the student's major field of study, and which is acceptable to the student's major department and to the Dean of the Graduate School. For any language other than French, German, or Russian, approval of the Dean must be requested by the student's adviser. A petition for such approval must give evidence that journals and other sources in the student's field are comparable to those in French, German, and Russian, that they are as readily available to the student and that they will be consulted during his dissertation research.

The Ph.D. programs offered through a number of departments require a reading knowledge of two foreign languages or of one language in greater depth than the minimum requirement of the Graduate School.

Language examinations are arranged by the Foreign Language Examiner who is a member of the faculty and is appointed by the Dean of the Graduate School with the advice of the chairman of the Department of Foreign Languages. Examinations are administered by a person or persons selected by the Foreign Language Examiner at stated times, in general, twice each semester and once during the summer. Material in the student's field of specialization is approved by the adviser, and the student is allowed to prepare in advance for examination of this material. When translating unfamiliar material, the student will be allowed to use a dictionary. If a student fails the examination, his adviser may request a review of his examination papers. This review will be conducted by a committee of three members appointed by the Dean of the Graduate School. One member of the committee shall be a member of the faculty of the Department of Foreign Languages. The Foreign Language Examiner shall report to the student's adviser and to the Dean of the Graduate School the results of language examinations and examination reviews.

The Foreign Language Examiner also administers the following:

The completion of 12 semester hours or equivalent of course work in an approved foreign language with a grade of B or better in the last three hours, at WVU or at any other institution of recognized standing, will be accepted as satisfying the reading requirement of a language, provided that it was completed no more than seven years prior to promotion to candidacy for the Ph.D.

The completion of French 206 at WVU with a grade of B or better within seven years of promotion to candidacy for the Ph.D. will be accepted as satisfying the reading requirement in French.

When a student is certified as having satisfied his language requirement and has successfully completed his qualifying examination he is promoted to candidacy for the Ph.D.

Program

The program of Ph.D. study is planned with the student's graduate adviser and committee to combine any or all of the following: Graduate courses of instruction, special seminars, independent study, supervised research, and supervised teaching designed to promote a broad and systematic knowledge of his field and to prepare the student for the comprehensive qualifying and final examinations and writing of the dissertation.

Residence

The program for the Ph.D. generally requires at least three years of full-time graduate study at WVU.

Dissertation

The candidate must submit a dissertation pursued under the direction of the faculty of this University on some topic in the field of the major subject. The dissertation must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. While conducting research or writing a dissertation the student must register **at the beginning** of each semester or summer session during which credit is being earned. No residence credit will be allowed for special field assignments or other work taken off the University campus without prior approval by the Dean of the Graduate School.

Special Requirements

The student must satisfy such special requirements, subject to the approval of the Dean of the Graduate School, as may be required by the faculty responsible for his major field. All of the requirements for the degree shall be completed within a period of seven years.

Final Examination

If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted, upon proof of current registration and approval by the Dean of the Graduate School, to a final oral examination on his dissertation before his examining committee. At the option of the department or the committee, a comprehensive final written examination also may be required. Results of the examination must be reported to the Office of the Graduate School within 24 hours. These results as well as acceptance of the dissertation, and certification of its suitability for immediate publication must be reported by the committee chairman to the Office of the Graduate School not later than one week before the end of the semester or summer session in which the degree is expected to be granted (one week

before the end of the summer session, one week before the end of the final examination period of the end of the first semester, or one week before Commencement Day at the end of the second semester).

Publication of Dissertation

All Ph.D. and other Doctoral Dissertations and their abstracts will be microfilmed through University Microfilms, Ann Arbor, Michigan. This requirement will not be satisfied by any other publication but does not preclude publication elsewhere which is both permitted and encouraged.

Candidates are to follow "Regulations Governing the Preparation of Dissertations and Theses" regarding format, paper, and organization of the dissertation and "A Review of Copyright Matters Related to Graduate Theses and Dissertations" for information pertaining to copyrights. Both of these papers are on file at the Office of the Graduate School, Department offices, offices of all Graduate advisers, and the University libraries. The candidate is required to maintain close contact with his supervisor or chairman of his graduate committee on these matters in developing his dissertation so as to incorporate the special requirements of the subject discipline.

One week before the close of the semester or summer session in which the degree is expected to be conferred the candidate must meet the following requirements as well as others described in the "Information and Check List for Doctoral Candidates" obtainable at the office of the Graduate School:

1. Submit to the Office of the Graduate School, in form satisfactory for microfilming, the typewritten, unbound original and first carbon copy of the dissertation signed by the candidate's committee. Two excellent machine-reproduced copies may be acceptable if approved in sample in advance and final copies conform.

2. Submit to the Office of the Graduate School one abstract as above of the dissertation consisting of no more than 600 words.

3. Submit to the Office of the Graduate School a microfilm contract completed and signed by the candidate.

4. Pay a fee of \$30.00 at the Office of the Graduate School to cover the cost of microfilming the dissertation and publication of the abstract in *Dissertation Abstracts*, a bi-monthly journal which receives wide distribution. Check must be made out to "Dissertation Service." If copyright service is desired, it can be provided through the Office of the Graduate School upon receipt along with the dissertation of a certified check for \$10.00 made payable to "University Microfilms."

5. Complete the questionnaire entitled "Survey of Earned Doctorates" obtained at the Office of the Graduate School and return it there.

Major Fields

Programs toward the Ph.D. are offered in the following major fields:

Aerospace Engineering	History
Agricultural Biochemistry	Mechanical Engineering
Agronomy	Microbiology (Med. and Agr.)
Anatomy	Music
Animal Nutrition	Pharmacology
Biochemistry (Medical)	Physics
Biology	Physiology
Chemical Engineering	Plant Pathology
Chemistry	Plant Physiology
Civil Engineering	Political Science
Economics	Psychology
Electrical Engineering	Reproductive Physiology
Genetics	Theoretical and
Geology	Applied Mechanics

THE DEGREE OF DOCTOR OF EDUCATION

The degree of Doctor of Education is offered through the College of Human Resources and Education. Programs leading to the degree with a major in Curriculum and Instruction and emphasis in Music Education are offered cooperatively with the Creative Arts Center and those leading to the degree with a major in Curriculum and Instruction and emphasis in Physical Education or Safety Education are offered cooperatively with the School of Physical Education. The major areas and emphasis are:

1. Curriculum and Instruction
 - a. Curriculum Development
(Elementary and Secondary areas)
 - b. Educational Psychology
 - c. Engineering Education
 - d. Health Education
 - e. Industrial Arts Education
 - f. Music Education
 - g. Physical Education
 - h. Reading
 - i. Safety Education
 - j. Special Education
2. Counseling and Guidance
3. Education Administration

THE DEGREE OF DOCTOR OF MUSICAL ARTS

The degree of Doctor of Musical Arts is offered through the Creative Arts Center.



PART 3

FINANCIAL INFORMATION

FEES AND EXPENSES

All University fees are subject to change without notice.

A non-refundable special service fee of \$10.00 must accompany applications for admission to the Graduate School.

All fees are due and payable at the Comptroller's Desk in the Coliseum on the days of registration. Students must pay fees before registration is accepted and class tickets are released. Completion of arrangements for payment from University payroll check, officially accepted scholarships, loan funds, grants, or contracts shall be considered sufficient for acceptance of registration. Fees paid after regular registration must be paid to the University Cashier in Mountainlair. Any student failing to complete registration on regular registration days is subject to the Late Registration Fee of \$10.00. Students registering pay the fees shown on page 43 plus special fees and deposits as required.

No degree will be conferred upon any candidate prior to payment of all tuition, fees, and other indebtedness to any unit of the University.

Special Fees

Late-registration Fee (non-refundable) ¹	\$ 10.00
Graduation Fee ²	10.00
Professional Engineering Degree (including \$10.00 Graduation Fee)	25.00
Student's Record Fee ³	1.00
Fee for Change in Registration (after 8th day)	1.00
Certificate of Advanced Study in Education	2.00
Fee for Reinstatement of Students Dropped From the Rolls	3.00
Fee for Examination of Candidates for Graduate Degree ⁴	1.00
Diploma Replacement Fee	5.00
Physical Education Student Fee	5.00
Student Identification Card Replacement Fee	1.00
Social Work Field Supervisory Fee (per semester) ...	70.00

¹This fee is not charged to full-time students who complete registration during the regular registration days as set forth in the University Calendar. This fee is not charged to part-time students who complete registration by the close of office hours on the eighth day following the beginning of General Registration.

²The Graduation Fee is payable by all students at the beginning of the semester or session in which they expect to receive their degrees.

³One transcript of a student's record is furnished by the Office of Admissions and Records without charge. This fee is charged for furnishing an additional transcript.

⁴For graduate students not otherwise enrolled at time of final examination.

Mountainlair Construction Fee and Daily Athenaeum Fee

The following fees are charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction at WVU in Morgantown:

Mountainlair Construction Fee ...	\$ 20.00 per semester
Daily Athenaeum Fee.....	\$ 1.50 per semester
Mountainlair Construction Fee ...	\$ 12.00 per summer term in excess of four and one-half weeks
Daily Athenaeum Fee.....	\$ 1.00 per summer session

These fees are non-refundable unless the student withdraws officially before the close of General Registration for the semester or course in which he has been enrolled.

Fees for Extension Courses

A fee of \$12.00 per semester hour and an off-campus extension fee of \$12.00 per course are charged for enrollment in each extension course. Fees for extension courses are due and payable at or prior to the first class meeting.

Undergraduate and Graduate Music Students

Full-time or part-time students registered for Bachelors' or advanced degrees in Music or the Supervisory Training Program in Music shall pay the regular full-time or part-time fees for all courses in music. No additional fees are assessed for Applied Music.

Students registered in other colleges or schools, including the Graduate School, may enroll in class courses in music at the regular full-time rate or part-time fee per credit hour. These students may also enroll for Applied Music for a maximum of one half-hour lesson per week. The fee for this Applied Music instruction shall be \$20.00 in addition to the aforementioned tuition and registration fees.

Laboratory Fees

Consult specific departmental sections of this *Catalog* for information concerning non-refundable laboratory fees, deposits, and microscope rental fee.

SEMESTER FEES IN THE COLLEGES AND SCHOOLS

(See Footnotes 5, 6, 7, 8)

College, School, Or Division	Full-Time	
	Resident	Nonresident
GROUP I Agriculture and Forestry Arts and Sciences Business and Economics Creative Arts Center Engineering Human Resources and Education Journalism Mines Physical Education Social Work	\$96.00* plus Registration Fee of \$50.00.	\$261.00* plus Registration Fee of \$200.00 and Nonresident Undergraduate Student Service Fee of \$100.00.
GROUP II Dental Hygiene Law Medical Technology (Jr. and Sr. Years) Nursing Pharmacy Physical Therapy	\$111.00* plus Registration Fee of \$50.00.	\$286.00* plus Registration Fee of \$200.00 and Nonresident Undergraduate Student Service Fee of \$100.00. (Law students excluded from Nonresident Undergraduate Service Fee).
GROUP III Dentistry Medicine	\$173.00* plus Registration Fee of \$50.00.	\$391.00* plus Registration Fee of \$200.00.

Part-Time

Tuition, per semester hour	Resident	Nonresident
Undergraduate students	\$ 9.00**	\$41.25***
Graduate and professional students (Dentistry, Law, Medicine)	14.00**	38.00***

*Includes Athletics Fee \$8.25; Student Educational Services Fee \$10.00; Daily Athenaeum Fee \$1.50; Health, Counseling, and Program Services Fee \$12.00; Mountainlair Construction Fee \$20.00; Inter-Campus Bus System Fee \$4.25.

**Includes \$4.00 per semester hour Registration Fee.

***Includes \$16.00 per semester hour Registration Fee and \$8.25 per semester hour Nonresident Undergraduate Student Service Fee.

Kanawha Valley Graduate Center (Institute, W. Va.): \$14.00 per semester hour for resident students; \$38.00 per semester hour for nonresident students.

SUMMER SESSION FEES

(Subject to change)

Tuition, (per semester hour)	Resident	Nonresident
Undergraduate students	\$ 9.00*	\$ 41.25**
Graduate and professional students (Dentistry, Law, Medicine)	14.00*	38.00**
Daily Athenaeum Fee†.....	1.00	1.00
Health, Counseling, and Program Services Fee†.....	7.00	7.00
Mountainlair Construction Fee per summer term in excess of four and one-half weeks††.....	12.00	12.00
Mountainlair Construction Fee per four and one-half-week summer term or any portion thereof††.....	6.00	6.00
Student Educational Services Fee....	5.00	5.00
Inter-Campus Bus System Fee†.....	2.00	2.00

*Includes \$4.00 per semester hour Registration Fee.

**Includes \$16.00 per semester hour Registration Fee and \$8.25 per semester hour Nonresident Undergraduate Student Service Fee.

†Non-refundable fees required of full-time students. May be paid by part-time students who desire the services. Part-time students who elect to pay these fees must pay the same amount assessed full-time students.

††Fee required of all students. (Non-refundable unless student withdraws officially before the close of general registration).

⁵ A full-time graduate student is one who is registered for 9 or more semester hours of work each semester of the regular academic year, 6 or more semester hours of work during a 9-week Summer Session, or 3 semester hours of work during a 4½-week Summer Term. A full-time student during the academic year receives an Identification Card which entitles him to admission to all athletic events. A full-time student during the regular academic year or during the Summer Session is entitled to free medical consultation and advice from the University physician. A moderate charge is made for room calls, X-rays, special laboratory tests, drugs furnished by the University Pharmacy, minor operations, treatment of fractures and dislocations, and intravenous treatment.

⁶ A part-time graduate student is one who is registered for fewer than 9 semester hours per semester during the regular academic year, or for fewer than 6 semester hours during a 9-week Summer Session, or for fewer than 3 semester hours during a 4½-week Summer Term.

⁷ The minimum rate for non-credit courses is that charged for one semester hour of credit.

⁸ Tuition, Registration Fee, Athletics Fee, Student Educational Services Fee, Health, Counseling, and Program Services Fee, and Inter-Campus Bus System Fee. The Mountainlair Construction Fee and Daily Athenaeum Fee are non-refundable after the twelfth day following the beginning of General Registration.

Auditors

Students may enroll in courses without working for grade or for credit by registering as auditors and by paying full fees. Change in status from audit to credit or from credit to audit may be made during the registration period. Attendance requirements for auditors shall be determined by the instructor of the course being audited. It is the prerogative of the instructor to strike the name of any auditor from grade report forms and to instruct the Office of Admissions and Records to withdraw the auditor from the class, if he should fail to meet such attendance requirements.

Remission of Fees

The tuition fee and registration fee will be remitted to a person registered in the Graduate School or the College of Law and who is employed by the University on a regular appointment, subject to the following:

(a) There will be no remission of the Daily Athenaeum Fee or of the Mountainlair Construction Fee. These fees are charged all students, full-time and part-time, who are enrolled for regular courses of resident instruction.

(b) Except as provided in "c", a graduate teaching or graduate research assistant will receive remission of tuition fee and registration fee commensurate with the hours of service required by the terms of his appointment.

(c) A faculty member on full-time appointment at any recognized institution of higher learning located in West Virginia who is taking a course of graduate study at the University and holds an appointment as a graduate assistant will receive full remission of tuition and registration fees.

(d) A regular appointment must be effective at the beginning of a semester or summer session. Exemption from tuition fee and registration fee must be claimed at the beginning of the registration period or, in the case of a substitute appointment, within ten days after the appointment has been made.

(e) An employee who holds a regular appointment and is eligible for remission of tuition fee and registration fee in the Second Semester of any regular academic year is also eligible for remission of tuition fee and registration fee in the Summer Session immediately following his term of appointment.

In certain cases an employee on regular University appointment may be permitted to register as a full-time student in the Graduate School or the College of Law. If such an employee does register as a full-time student and qualifies for remission of tuition fee and registration fee, he shall not be subject to the Special Services Fee, except the Daily Athenaeum Fee and the Mountainlair Construction Fee, but must pay such fees to be entitled

to the services provided thereby. Such employees do not receive the Student Identification Card which provides for athletic admissions, student educational services, health, counseling, and program services, etc.

University Employees

The spouse and dependent children of any person employed full-time by West Virginia Board of Regents shall be charged the same fees as resident students. The spouse and dependent children of full-time interns, residents, and fellows in the School of Medicine, School of Dentistry, and University Hospital programs shall also be charged the same fees as resident students.

Refunding of Fees

A student who officially withdraws from University courses may arrange for a refund of fees by submitting to the University Comptroller evidence of eligibility for a refund.

To withdraw officially from the University a student must apply to the Dean of Admissions and Records for permission. Semester fees will be returned in accordance with the following schedule:

First refund period ending on the twelfth day following the beginning of General Registration	} All Activity fees chargeable to Special Services and all other semester fees less \$2.50. (Under no circumstances is the amount retained less than \$2.50.)
Second refund period ending on the fifth Friday following the beginning of General Registration	} 70% of all refundable fees ⁸
Last refund period ending on the eighth Friday following the beginning of General Registration	} 40% of all refundable fees ⁸

The second Friday following the beginning of General Registration for the Summer Session or a Summer Term is the end of the refund period.

No part of the Activity Fee is refundable unless the student withdraws from the University.

University policy provides that students called to the armed services of the United States may be granted full refund of refundable fees, but no credit, if the call comes before the end of the first three-fourths of the semester, and that full credit by courses be granted to persons called to the armed services of the United States if the call comes thereafter; provided, however, that credit as described above will be granted only in those courses

in which the student is maintaining a passing mark at the time of his departure for military service. In the recording of final grades, for three-fourths of a semester or more, both passing and failing grades are to be shown on the student's permanent record card.

Service Charge on Returned Checks

A service charge of 5 per cent of the amount of each check returned unpaid by the bank upon which it is drawn shall be collected unless the student can obtain an admission of error from the bank.

If the check returned by the bank was in payment of University and registration fees, the Comptroller's Office shall declare the fees unpaid and registration cancelled if the check has not been redeemed within three days from date of written notice. In such a case the student may be reinstated upon redemption of the check, payment of the 5 per cent service charge, Reinstatement Fee of \$3.00, and Late Payment Fee of \$10.00.

RESIDENTIAL STATUS

The West Virginia Board of Regents at its meeting February 2, 1971, adopted the following regulations governing the classification of students as residents or nonresidents for admission and fee purposes at all institutions under its jurisdiction, effective the Fall Semester of 1971:

General

Students enrolling in a West Virginia public institution of higher education shall be classified as resident or nonresident for admission, tuition, and fee purposes by the Registrar or other officer designated by the President. (At WVU, the Dean of Admissions and Records.) The decision shall be based upon information furnished by the student and all other relevant information. The Registrar is authorized to require such written documents, affidavits, verifications, or other evidence as are deemed necessary to establish the domicile of a student, including proof of emancipation, adoption, award of custody, or appointment of a guardian. The burden of establishing that a student is exempt from paying the nonresident tuition and fees is upon the student.

If there is a question as to residence, the matter must be brought to the attention of the Registrar and passed upon at least two weeks prior to registration and payment of tuition and fees. Any student found to have made a false or misleading statement concerning his residence shall be subject to dismissal from the college.

For purposes of resident and nonresident classifications, the word "parents" as herein used shall include legal guardians.

Residence Determined by Domicile

Domicile within the state means adoption of the state as a fixed permanent home and involves personal presence within the state. West Virginia domicile is presumed to be established upon the completion of at least twelve months of continued residence within the state prior to the date of first registration, provided that such twelve months residency is not for the purpose of attendance as an undergraduate or graduate student at any institution of learning in West Virginia.

Establishment of West Virginia domicile with less than twelve months residence prior to the date of first registration must be supported by proof of positive and unequivocal action such as the purchase of a West Virginia home, establishment of a permanent place of residence, full-time employment within the state, and assessment of property tax. Proof of one or more of these actions shall be considered only as evidence which may be used in determining whether or not a domicile has been established.

There must be no intent on the part of the person involved to return to another state or country.

Minors

The residence of a minor shall follow that of the parents at all times, except in extremely rare cases where emancipation can be proved beyond question. The residence of the father, or the residence of the mother if the father is deceased, is the residence of the unmarried or unemancipated minor. If the father and the mother have separate places of residence, the minor takes the residence of the parent with whom he lives or to whom he has been assigned by court order. The parents of a minor will be considered residents of West Virginia if their domicile is within the state.

An unemancipated minor student loses resident status twelve months after his parents have ceased to maintain a domicile in West Virginia.

Emancipated Minor

An emancipated minor may be considered as an adult in determining residence, provided satisfactory evidence is presented that his parents, or legal guardian, if living, do not contribute to his support and do not claim him as a dependent for federal government income tax purposes.

In the event that the fact of emancipation is established, the emancipated minor assumes all of the responsibilities of an adult to establish residence for tuition and fee purposes. Proof must be provided that emancipation was not achieved principally for the purpose of establishing residence for attendance at an institution of higher education.

An emancipated minor, orphan, or abandoned child who has been domiciled in West Virginia for at least one year following

his emancipation and next preceding the date of registration may be classified as a resident for tuition and fee purposes.

Students Over 21 Years of Age

A resident student twenty-one years of age is (1) one whose parents were residents of the state at the time he reached his majority and who has not acquired a domicile in another state, or (2) who, while an adult, has established a bona fide domicile in the State of West Virginia. Bona fide residence in West Virginia means that the student must not be in the state primarily to attend a college and he must be in the state for purposes other than to attempt to qualify for resident status.

Any nonresident student who reaches the age of twenty-one years while a student at any school or college in West Virginia does not by virtue of such fact attain residence in this state for admission or tuition and fee payment purposes.

A student who is classified as a resident at the time that he reaches the age of twenty-one shall continue to be classified as a resident provided that he retains a domicile in West Virginia and that he does not establish a domicile, or legal residence, in another state.

Marriage

The residence of a married woman is determined by the rules which would apply to her husband if he were to seek enrollment, except that a woman who would have been classified as a West Virginia resident immediately prior to her marriage may continue to be classified as a West Virginia resident if she continues to be domiciled in the state.

Military

An individual who is on active federal military service or an employee of the federal government may be classified as a resident for the purpose of payment of tuition and fees provided he had established domicile in West Virginia prior to entrance into federal service, that he entered the federal service from West Virginia, and that he has at no time while in federal service claimed, or established, a domicile in any other state. Sworn statements attesting to these conditions may be required. The wife and dependent children of such individuals shall also be classified as residents of the State of West Virginia for tuition and fee purposes.

Aliens

An alien who has entered the United States on a resident visa, or who has taken out first papers for citizenship, and who has established a bona fide residence in West Virginia by living in the state for at least twelve consecutive months immediately

preceding registration may be eligible for resident classification, provided he is in the state for purposes other than to attempt to qualify for resident status as a student.

Higher Education Personnel

Full-time employees of the West Virginia Board of Regents and the institutions under its jurisdiction, full-time ROTC personnel assigned to the institutions, and their spouses and dependent children, shall be considered West Virginia residents for the purpose of the payment of tuition and fees.

Appeal Process

The decisions of the Registrar or other officer charged with the determination of residence classification may be appealed to the President of the institution. The President may establish such committees and procedures as he determines necessary for the processing of appeals. The decision of the President of the institution may be appealed in writing with supporting documentation to the West Virginia Board of Regents. The appeal will be reviewed by the State Committee on Residency which shall make recommendations to the Board for final decision. The members of the State Committee on Residency shall be appointed by the Board of Regents.

ABBREVIATIONS

- I—a course given in the first semester.
- II—a course given in the second semester.
- I, II—a semester course given in each semester.
- I and II—a course given throughout the year.
- S—a course given in the Summer Session.
- hr.—number of credit hours per course.
- rec.—recitation period.
- lab.—laboratory period.
- conc.—concurrent registration required.
- PR.—prerequisite.
- consent—consent of instructor required.

NOTE: Summer courses carry the same credit value as courses offered in the regular semesters.

PART 4

PROGRAMS AND COURSES OF STUDY

PLAN FOR NUMBERING COURSES

For convenience each course of study is designated by the name of the department in which it is given and by the number of that course. The plan for numbering is as follows:

Courses 200 to 299—Courses for advanced undergraduate students and selected graduate students. No more than 40 per cent of 200-level credits can be counted for meeting requirements for a graduate degree.

Courses 300 to 399—Courses for graduate students; students in professional programs leading to the doctorate; and selected, advanced undergraduates. Undergraduates in any class carrying a 300 course number should have a 3.0 cumulative grade-point average and have written approval on special forms of their instructor and adviser and the graduate school dean. Seniors within 12 semester hours of graduation may, with the prior approval, on special senior petition forms of adviser and graduate school dean, enroll in 300-level graduate courses. (In summary, 200-level courses are intended primarily to serve the undergraduate students. If the graduate enrollment in a 200-level course with undergraduates enrolled regularly exceeds 25 per cent of the total, the department should reevaluate the course numbering. The 300-level courses are intended primarily to serve introductory graduate and master's degree course needs. If the undergraduate enrollment in any 300-level course regularly exceeds 20 per cent of the total, the department should also reevaluate the course numbering. Graduate degree credit hour requirements must include at least 60 per cent of the total at the 300 and 400 level).

Courses 400 to 499—Courses for graduate students only. All doctor's degree dissertation hours shall be awarded at the 400 level—specifically under course number 497. Graduate degree credit hour requirements must include at least 60 per cent at the 400 and 300 level.

College of Agriculture and Forestry

AGRICULTURE

The Degree of Master of Agriculture

Admission

Admission requirements are those established by the Graduate School for master's degree candidates. Students desiring to seek this degree must obtain approval from the Master of Agriculture Committee in the College of Agriculture and Forestry. The student's baccalaureate should be in a field sufficiently related to the course of study contemplated to provide the necessary background. Students whose baccalaureate is in a field considered not sufficiently related to the study contemplated may be admitted on probation until specified requirements are met or may be admitted on the basis of evidence of satisfactory professional experience.

Requirements for Graduation

The program of work for this degree emphasizes breadth of knowledge in the general field of agriculture rather than upon one narrow field of science. Students must select a minimum of one three-credit-hour course in each of four subject matter groups shown in the list below and complete a minimum of 20 semester hours of work within the Divisions of Animal and Veterinary Sciences, Plant Sciences, and Resource Management. The student may choose the additionally required courses from offerings within the College of Agriculture and Forestry or from offerings of other colleges and schools of the University. No more than 12 semester hours of credit in any specified subject-matter group will be counted toward meeting the minimum degree requirements. The student must achieve an overall "B" or 3.0 average on all approved course work for which enrolled.

Subject Matter Groups:

1. Agricultural Economics, Agricultural Education
2. Agricultural Mechanics
3. Animal and Veterinary Sciences
4. Bacteriology, Entomology
5. Agricultural Biochemistry, Genetics
6. Food Science
7. Landscape Architecture
8. Plant Sciences (Agronomy, Horticulture, Plant Pathology)
9. Soil Science

Study Options

Students may choose either of the following two study options:

1. *Problem Report Option.* Completion of a minimum of 30 semester credit hours of work including a problem report. The problem report will count for not more than three credit hours toward fulfillment of the 30-hour requirement.

The problem report may be based on a professional action program including development of professional materials, a plan for solving a pertinent problem, or preparing a research report based on information from original or secondary sources. The problem report must be approved in advance by the student's Graduate Committee. On completion of the required course work and problem report, the student will be given an oral examination by his Graduate Committee, and at the Committee's discretion, may also be given a written examination.

2. *Course-Work Option.* Completion of 36 semester credit hours of approved graduate courses. On completion of the course work, each candidate must undergo both a written and an oral examination by his Graduate Committee.

Agriculture

200. **Agricultural Travel Course.** S. 6 hr. Tour and study of production methods in major livestock and crop regions of the United States and other countries. Influence of population, climate, soil, topography, markets, labor, and other factors on agricultural production.

360. **Problem Report for the Degree of Master of Agriculture.** I, II, S. 1-3 hr.

AGRICULTURAL BIOCHEMISTRY

The Interdivisional Committee of Agricultural Biochemistry within the College of Agriculture and Forestry is responsible for the planning and conduct of course offerings in Agricultural Biochemistry and the graduate degree programs in Agricultural Biochemistry.

In addition to the requirements for admission to the Graduate School, applicants for admission to the graduate degree programs in Agricultural Biochemistry must have an overall minimum grade-point average of 2.5 in general, analytical, organic, and physical chemistry. Deficiencies in these courses may be removed during the first year of graduate enrollment if prior consent is obtained from the Agricultural Biochemistry faculty.

The agricultural biochemistry student must attain a minimum final grade-point average of 3.0 in his formal graduate course work, which is approved early in his graduate enrollment.

The Degree of Master of Science

Work for the degree of Master of Science consists chiefly of course offerings selected according to the special needs of the student from 300 and 400 courses in agricultural biochemistry, medical biochemistry, chemistry, statistics, and the biological sciences. A total of no fewer than 30 hours of graduate credit is required of which no more than 6 may be for research. A thesis is required.

The Degree of Doctor of Philosophy

Applicants for the degree of Doctor of Philosophy must pass comprehensive written and oral examinations in biochemistry and one or two minor fields. The applicant does not become a candidate for the degree until he has satisfied the foreign language requirement and passed the comprehensive examination.

Agricultural Biochemistry

Agr. Biochem.

- 210. **Introductory Biochemistry.** I, II. 3 hr. PR: Two semesters of General Chem. and one semester of Organic Chem. The biochemistry of the proteins, carbohydrates, lipids, nucleic acids, enzymes, coenzymes, and cellular metabolism in plants and animals.
- 212. **Animal Biochemistry.** II. 3 hr. PR: One semester of Biochemistry. Nutritional and physiological chemistry of domestic animals.
- 213. **Introductory Biochemistry Laboratory.** II. 2 hr. PR: Agr. Biochem. 212. A laboratory course in nutritional biochemistry.
- 310. **General Biochemistry.** I. 3 hr. PR: 8 hr. Organic Chem. A general course in biochemistry primarily intended to meet the needs of graduate students.
- 311. **Laboratory Experiments in Biochemistry.** I. 2 hr. PR: Agr. Biochem. 310 or concurrent registration. Experiments to demonstrate some of the basic tools and procedures of biochemical research.
- 312. **General Biochemistry.** II. 3 hr. PR: Agr. Biochem. 310 or consent. A continuation of Agr. Biochem. 310.
- 313. **Advanced Biochemistry Laboratory.** II. 2 hr. PR: Agr. Biochem. 311 and Agr. Biochem. 312 or concurrent registration. Application of modern biochemical techniques to experimentation in animal and plant metabolism.
- 314. **Radionuclide Biochemistry.** II. 3 hr. PR: Chem. 1, 2, 131, or consent. Radionuclide methods and isotope handling as needed by students interested in biological research.
- 410. **Biochemistry of Carbohydrates.** I. 3 hr. PR: Agr. Biochem. 312 or consent. The structure, properties, and metabolism of sugars and polysaccharides. Offered in Fall of odd years.
- 412. **Lipid Biochemistry.** I. 3 hr. PR: Agr. Biochem. 312 or consent. A consideration of the chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways within the cell and cellular particulates. Offered in Fall of even years.

414. **Enzymes.** II. 3 hr. PR: Agr. Biochem. 312, or consent. A general survey of the chemistry of enzymes for the advanced student.
416. **Vitamins.** I. 2 hr. PR: Agr. Biochem. 312 or consent. Identification, nomenclature and chemical structures, biochemical systems, biogenesis, pathology and requirements of vitamins and vitamin like compounds. Offered in Fall of odd years.
418. **Mineral Metabolism.** I. 3 hr. PR: Agr. Biochem. 312 or consent. The inorganic and biochemistry of the minerals in the body and the physiological function of minerals are studied. A special term paper is required of each student on the chemical metabolism studies. Offered in Fall of even years.
420. **Special Topics.** I, II, S. 2-4 hr. PR: Consent.
422. **Plant Biochemistry.** I. 3 hr. PR: Agr. Biochem. 312 or consent. An advanced treatment of the composition and metabolism of plants. Offered in Fall of odd years.
450. **Seminar.** I, II. 1 hr. per sem.
497. **Research.** I, II, S. 1-15 hr.

DIVISION OF ANIMAL AND VETERINARY SCIENCES

The Division offers a Master of Science program in Animal Science and a Doctor of Philosophy program in Animal Nutrition. The division participates in an interdivisional Doctor of Philosophy program in Agricultural Biochemistry and in intercollege programs in Genetics and Reproductive Physiology.

The Master of Science program in Animal Science allows maximum flexibility in courses and research problems. Students may work with beef and dairy cattle, sheep, swine, poultry, rats, mice, and meadow voles. They may emphasize physiology, pathology, production, breeding, or nutrition. Research problems in farm animals form the basis for many studies, but the comparative approach is emphasized.

Admission requirements are similar to those in other biological sciences. The student should have completed basic courses in the physical and biological sciences, including genetics, nutrition, and physiology. For the program in Animal Nutrition, analytical chemistry and organic chemistry (one year) are required. Deficiencies may prolong the time needed to complete degree programs.

Twenty-four approved hours of course work and a thesis are required for all Master of Science degrees. The doctoral programs are governed by the general regulations of the Graduate School.

Animal and Veterinary Science

A&VS

420. **Special Topics.** I, II, S. 1-4 hr. (1 hr. credit in special cases only). Advanced study in particular phases of such animal science topics as animal production, nutrition, physiology, breeding and genetics, veterinary science, and food science. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).

Animal Nutrition

An. Nutr.

- 294. **Poultry Nutrition.** II. 3 hr. PR: An. Nutr. 101. Nutritional requirements, nutrient interrelationships, and nutritional deficiencies of all types of domesticated fowl.
- 301. **Principles of Nutrition and Metabolism.** I. 3 hr. PR: Agr. Biochem. 210, An. Physiol. 100, or equiv. A basic course in animal nutrition.
- 305. **Comparative Nutrition and Metabolism.** II. 3 hr. PR: An. Nutr. 301 or consent. A comparative study of the utilization of dietary nutrients by species of laboratory and domestic animals and man. Offered in odd years.
- 306. **Nutrition Laboratory Methods.** II. 3 hr. PR: An. Nutr. 301 or concurrent registration. Chemical, physical, and biological methods used in animal nutrition research.
- 407. **Advanced Nutrition and Metabolism.** I. 3 hr. PR: Agr. Biochem. 311 or consent. Advanced treatment of the nutrition, metabolism, nutrient interrelationship, and metabolic regulatory mechanisms of domestic animals.
- 409. **Nutrition and Physiology of the Ruminant.** I. 3 hr. PR: An. Physiol. 100; An. Nutr. 101; Agr. Biochem. 310. A study of the nutritional and physiological processes peculiar to the ruminant animal. Offered in even years.
- 411. **Problems in Nutritional Physiology.** I. 3 hr. PR: An. Nutr. 305 or consent. Consideration of the interrelation of nutrition with growth, reproduction, environment, disease, and related areas. Offered in even years.
- 450. **Seminar.** I, II. 1 hr.
- 497. **Research.** I, II, S. 1-15 hr.

Animal Physiology and Breeding

An. Physiol. & An. Br.

- 204. **Animal Physiology Laboratory.** I. 2 hr. PR: An. Physiol. 100 or concurrent registration. Laboratory study of the physiological systems of animals and the influence of environment on these systems.
- 225. **Physiology of Reproduction.** II. 3 hr. PR: Course in Biology. Comparative physiology of reproduction in higher animals; endocrine functions involved in reproduction; genetic and environmental variations in fertility mechanisms.
- 226. **Breeding of Farm Animals.** I. 3 hr. PR: Course in Genetics or consent. Application of principles of quantitative genetics to the improvement of farm animals.
- 280. **Behavioral Patterns of Domestic Animals.** II. 3 hr. (1 lab.). Examination of the bases for and exhibition and control of behavioral patterns of domestic animals.
- 425. **Endocrinology of Reproduction.** II. 4 hr. (2 labs.). PR: An. Physiol. 225 or Biol. 268 or equiv. Discussion of and laboratory experience in classical and current concepts of hormonal and neurohormonal regulation of reproductive phenomena with emphasis on species differences and similarities.

- 426. **Advanced Animal Selection.** II. 3 hr. PR: Course in Statistics and course in Genetics or equiv. An advanced course dealing with the basic concepts of experimental and statistical approaches in the analysis of quantitative inheritance with special reference to the magnitude and nature of genotypic and non-genotypic variability. Offered in even years.
- 450. **Seminar.** I, II. 1 hr.
- 497. **Research.** I, II, S. 1-15 hr.

Animal Production

An. Prod.

- 240. **Advanced Poultry Production.** I. 3 hr. Special phases of broiler and egg production, disease control, laborsaving studies, and recent designs in housing and equipment for all types of poultry. Offered in even years.
- 250. **Current Literature in Animal Science.** I. 3 hr. PR: An. Nutr. 101. Evaluation of current research in animal science and its application to production and management.
- 422. **Advanced Milk Production.** II. 3 hr. PR: An. Nutr. 101 or consent. Advanced study of the feeding, breeding, and management of dairy cattle.
- 450. **Seminar.** I, II. 1 hr.
- 497. **Research.** I, II, S. 1-15 hr.

Food Science

Food Sci.

- 267. **Advanced Meats.** II. 3 hr. (2 labs.). PR: Food Sci. 167. Studies covering composition of meat, complete fabrication of meat animal carcasses, factors influencing yield, physiology, and chemistry of pertinent phenomena, and merchandising of meat. Offered in even years. (Transportation for required trips in connection with this course will generally be supplied by the College. Students will be responsible for their meals and lodging.)

Veterinary Science

Vet. Sci.

- 210. **Principles of Laboratory Animal Science.** II. 3 hr. (1 lab.). PR: Consent for undergraduates. The management, genetics, physiology, nutrition, disease, and germ-free quartering of the common laboratory animals.
- 301. **Surgery.** (Same as Surg. 301). I. 3 hr. (1 lab.). Introduction to laboratory animal experimentation.
- 306. **Parasitology.** II. 3 hr. PR: Course in Biology. Common parasites of farm animals, their control, and their effect upon the host. Offered in odd years.
- 450. **Seminar.** I, II. 1 hr.
- 497. **Research.** I, II, S. 1-15 hr.

DIVISION OF FORESTRY

The Division of Forestry offers graduate study leading to the degrees of Master of Science in Forestry and Master of Science. Students seeking the Master of Science in Forestry degree may major in forest ecology, forest economics, forest genetics, forest hydrology, forest management, forest protection, forest recreation, silviculture, or wood industries. Students who wish to obtain the Master of Science degree may major in wildlife management, recreation, or wood science.

Applicants for graduate work in the Division of Forestry must have as a minimum requirement a bachelor's degree, with appropriate background in the subject matter area of his major field.

A candidate for the degree of Master of Science in Forestry, or Master of Science with a major in wildlife management or wood science, must pass satisfactorily 30 credits of approved work, 6 of which credits shall constitute a thesis.

A candidate for the degree of Master of Science with a major in recreation has the option of earning the degree on the basis of 30 hours with a thesis or 36 hours without a thesis.

Forestry

For.

- 219. **Forest Hydrology.** II. 3 hr. PR: Consent. Description and quantitative treatment of the hydrologic cycle in nature, with primary emphasis on the role of forest and the principles of silvicultural water management.
- 220. **Forest Policy and Administration.** II. 3 hr. Forest policy in the United States; important federal and state laws; administration of public and private forests; problems in multiple-use forestry.
- 226. **Remote Sensing of Environment.** II. 2 hr. PR: Math. 3 and Math 4. Principles of measurement and interpretation of natural resources and environment from photography, radar, infrared, and microwave imagery.
- 233. **Principles of Industrial Forestry.** I. 3 hr. PR: Senior standing or consent. Analysis and case studies of problems pertinent to the integration of wood conversion technology with principles of production, marketing, and management.
- 319. **Microclimatology.** II. 3 hr. PR: Consent. A description and quantitative treatment of climate near the ground in terms of physical and physiological processes of energy and mass exchange.

Forest Management

F.M.

- 211. **Silvicultural Systems.** I. 4 hr. PR: F.M. 12. Principles of regeneration cuttings, intermediate cuttings, and cultural operations, with their application to forest stands.
- 213. **Regional Silviculture.** I. 2 hr. PR: F.M. 12; PR or conc: F.M. 211. Major forest types of the United States—their composition, management, problems, and silvicultural treatment.

215. **Principles of Artificial Forestation.** II. 3 hr. PR: F.M. 12. Seeding and planting nursery practice; phases of artificial regeneration.
216. **Forest Genetics and Tree Improvement.** I. 3 hr. PR: Genet. 272 or equiv., or consent. A study of forest genetic principles and their application to forest tree improvement including crossing methods, selection systems, and other tree improvement techniques.
222. **Forest Mensuration.** II. 3 hr. PR: F.M. 122. The measurement of growth and yield; statistical methods applied to forest measurement problems.
230. **Principles of Forestry Economics.** II. 3 hr. PR: Econ. 51 and 52 or equiv. The economics of production, distribution, and use of forest goods and services. Emphasis is on analytical methods and techniques in dealing with forest economic problems.
232. **Forest Finance.** II. 2 hr. PR: Junior standing. Interest, discount, and rate earned in forest production and exploitation. Particular reference to the problems of forestry such as determining the value of standing timber, the appraisal of forest damages, and forest taxation.
233. **Forest Management.** I. 4 hr. PR: Summer Camp; PR or conc: F.M. 211. The principles of sustained yield forest management. Organization of the forest area, selection of management objectives, application of silvicultural systems, and regulation of the cut. The forest management plan.
234. **Forest Management Plans.** II. 2 hr. PR: F.M. 233. Analyses of forest management plans. Construction of a sustained yield timber management plan for a specific forest tract.
330. **Advanced Principles of Forestry Economics.** I. 3 hr. PR: Econ. 51 and 52 or equiv.; F.M. 230 or equiv. Intensive study of both micro- and macro-economics of forestry.
411. **Environmental Relationships in Hardwood Forests.** I. 3 hr. PR: F.M. 211. The study of environmental factors affecting establishment, composition, and growth of hardwood forests.
412. **Silvicultural Practices for Hardwood Forest Types.** II. 3 hr. PR: F.M. 211, 213. Designing proper silvicultural systems for managing Appalachian hardwood stands; reconstructing stand histories, recognizing problems, and prescribing appropriate silvicultural treatment.
431. **Advanced Forest Regulation.** I, II. 2 hr. PR: F.M. 233 or equiv. An intensive study of area and volume regulation suitable for applied forestry in the United States.
470. **Special Topics.** I, II. 1-6 hr. per sem. PR: Consent. (For the Master of Science Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
472. **Seminar in Silviculture.** I, II. 1-6 hr. per sem; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of silviculture with emphasis on hardwood forest types.
473. **Seminar in Forest Management.** 1 hr.
497. **Research.** I, II, S. 1-15 hr.

Wood Science

W.S.

231. **Wood Finishing.** I. 3 hr. PR: W.S. 121 or consent. A technical course in wood finishing covering surface preparation, composition of finishing materials, equipment, techniques, defects, troubleshooting, and quality control.

232. **Theory and Practice of Wood Adhesion.** I. 3 hr. PR: W.S. 123, 141, or consent. Detailed theoretical introduction and examination of different types of adhesives and gluing techniques used in the wood industry.
234. **Statistical Quality Control.** II. 3 hr. PR: W.S. 134 or consent. A study of methods used to control quality of manufactured wood products. Control charts of variables and attributes. Acceptance sampling techniques. Offered in spring semester of even years.
240. **Wood Moisture Relationships.** II. 3 hr. PR: W.S. 123. A study of the principles involved in the relation between wood and moisture, and purposes, effects, and methods of seasoning.
251. **Forest Products Protection.** II. 3 hr. PR: W.S. 123, 134, or consent. A study of the biological organisms responsible for the deterioration of wood products, their control by preservative methods, and a study of fire retarding methods.
320. **Wood Microstructure.** I. 3 hr. PR: W.S. 123, senior standing, or consent. A detailed examination of wood microstructure as it relates to processing, behavior, and identification.
470. **Special Topics.** I, II. 1-6 hr. per sem.
473. **Seminar in Wood Utilization.** I, II. 1 hr. per sem.; max. credit, 4 hr. PR: Consent. Reports and discussions of recent research in fundamental and applied phases of wood utilization.
497. **Research.** I, II, S. 1-15 hr.

Wildlife Management

W.M.

213. **Wildlife Ecology.** I. 4 hr. PR: Biol. 1 and 2. Basic principles of ecology and their application to wildlife. Field and laboratory studies of major ecosystems important to wildlife, including management of these ecosystems for wildlife.
224. **Forest Zoology.** 3 hr. PR: Biol. 2. The relationship of mammals, birds, reptiles and amphibians to the forest, with emphasis on taxonomy, ecology, and the changing environment of these groups.
231. **Wildlife Techniques.** 3 hr. PR: W.M. 213, Biol. 151, or consent. Field and laboratory techniques necessary in the management and study of wildlife; collection of data, analysis, literature, report writing, habitat evaluation, and censusing are stressed.
234. **Principles of Wildlife Management.** II. 3 hr. PR: W.M. 213 or consent. A survey of the major game animals and the problems and principles involved in their management.
312. **Wildlife Population Ecology.** I. 3 hr. PR: W.M. 131 or equiv.; Stat. 211 or equiv. Theory of population growth, population change, intraspecific and interspecific relationships that are involved in the natural regulation of population and the effects of exploitation on wildlife populations.
370. **Wildlife Seminar.** II. 1 hr. per sem.; max. credit 4 hr. PR: Consent. Discussion of current developments in wildlife management.
434. **Ecology and Management of Upland Wildlife.** II. 4 hr. PR: Consent. Ecology and management of upland game birds and mammals, with emphasis on recent literature. Offered in spring semester of odd years.

- 436. **Ecology and Management of Wetland Wildlife.** II. 4 hr. PR: Consent. Ecology and management of waterfowl and wetland furbearers with emphasis on recent research and management literature. Offered in spring semester of odd years.
- 470. **Special Topics.** I, II. 1-6 hr. per sem.
- 497. **Research.** I, II, S. 1-15 hr.

Recreation and Parks

R.P.

- 202. **Field Work.** 3 hr. Recreation majors are required to have at least 8 weeks of supervised recreation leadership field work, usually during summer following junior year and after completion of upper-level recreation courses. Arrangements under the direction of chairman.
- 233. **Park Management.** I. 3 hr. PR: Junior standing. Introduction to administration and management problems associated with provision of recreation in parks under both private and public control.
- 251. **Recreation Leadership.** I. 3 hr. Meaning of leadership, its application to the field of recreation, and analysis of techniques. Examination of social group work method and its application, particularly in national youth organizations.
- 263. **Program Planning.** II. 3 hr. PR: R.P. 1. Fundamentals for general program planning; considering needs, facilities, age groups, local customs, climatic factors, etc. Planning involved in playgrounds, indoor centers, playfields, parks, hospitals, voluntary agencies, industry, and camps.
- 265. **Functional Planning of Recreation and Park Facilities.** II. 3 hr. Lecture and workshop. Problems and principles governing the planning for functional and effective usage of facilities in recreation. Emphasis on playgrounds, playfields, indoor centers, parks, camps, and swimming pools.
- 271. **Administration of Camping Services.** II. 3 hr. PR: R.P. 40 or equiv. or consent. Principles involved in modern camping programs; organization and administration of camps.
- 316. **Philosophy of Recreation.** II. 3 hr. PR: Consent. Interpretation of recreation as a basic part of the living process; importance to individual community and national welfare; and social and economic significance.
- 324. **Outdoor Recreation in Our Modern Society.** II. 3 hr. PR: For persons in fields of recreation, park, outdoor education and conservation, or by consent. Interpretation as to what it is, what people do, where they go, how this affects our economic, social, and cultural life, and significant trends.
- 335. **Administration of Recreation.** I. 3 hr. PR: Major in recreation or consent. General principles of administration; organization of staff administrative procedures. Study of enabling laws, legal responsibilities, surveys, finance, programs, facilities, and public relations.
- 348. **Outdoor Education and School Camping.** 3 hr. PR: For majors in education, recreation, extension, forestry, or by consent. Course designed to meet the needs of schools, colleges, and other education and conservation agencies interested in developing outdoor education programs. Emphasis is upon interpretation and programming of the outdoor education concept.

408. **Practicum in Recreation.** I, II. 4 hr. PR: R.P. 472, PESE 396 and 397. Program planning, curriculum development, and job functions in recreation.
415. **Leisure and Recreation.** I. 3 hr. PR: Consent. Study of leisure as a social phenomenon in our modern culture and its implications for recreation.
421. **Human Interest Areas in Recreation Planning.** I. 3 hr. PR: R.P. 316 or 20 hr. in Education or equiv. Exploration of the human interest areas which are the sources of recreation program content. Their adaptation to school and municipal recreation program planning. Offered in fall semester of odd years.
462. **Community Recreation.** I. 3 hr. PR: R.P. 316 or consent. A study of problems related to the provision of adequate recreation services for a community. Standards and quality of recreation service; methods of measuring existing services and their coordination; and community organization procedures. Course is designed for leaders in voluntary agencies, schools, churches, and municipal recreation organizations. Offered in fall semester of even years.
470. **Special Topics.** I, II. 1-6 hr. per sem.
472. **Seminar in Recreation.** I, II. 4 hr. PR: R.P. 316. An overview and critical analysis of the literature and research in recreation.
497. **Research.** I, II, S. 1-15 hr.

DIVISION OF PLANT SCIENCES

The Division of Plant Sciences offers the Master of Science (M.S.) degree with majors in Agronomy (crops or soils), Entomology, Horticulture, Microbiology, and Plant Pathology, and the Doctor of Philosophy (Ph.D) degree with majors in Agronomy, Microbiology, and Plant Pathology.

In addition, M.S. and Ph.D degrees are offered cooperatively in an intercollege program with majors in Developmental Biology, Genetics, and Plant Physiology, and with the Division of Animal and Veterinary Sciences with a major in Agricultural Biochemistry.

Facilities for graduate research include several farms, greenhouses, growth chambers, and well equipped laboratories.

To enter graduate work, the student must have a Bachelor's degree from any approved college and an adequate background in the physical and biological sciences. Additional undergraduate work may be required according to the needs of the field of specialization followed by the student. The schedule of courses required for graduate study will vary with the major, and will be developed in consultation with the student's adviser and advisory committee.

A candidate for the Master's degree must pass satisfactorily 30 hours of approved work of which 6 hours may be for a thesis. A thesis is required. Admission to candidacy for the Ph.D degree is conditioned upon a suitable period of residence and demonstrated ability to do work of graduate caliber; this is usually estab-

lished by passing a qualifying examination given by the faculty in his field of study.

The general regulations of the Graduate School apply to all programs of graduate study in the Division of Plant Sciences.

Agronomy (Crop Science)

Agron.

- 250. **Turfgrass Management.** I. 3 hr. PR: Agron. 2, or consent. The establishment, maintenance, and adaptation of grasses and legumes for lawns, golf courses, parks, athletic fields, and roadsides. An understanding of turfgrass management will be developed by associating differential plant responses with soil, climatic, and biotic factors that influence plant species growth, selection, and adaptation. Offered in Fall of even years.
- 251. **Weed Control.** I. 3 hr. PR: Plant Sci. 52 and Agron. 2, or consent. Fundamental principles of weed control. Recommended control measures for and identification of common weeds. 2 lec., 1 lab. Offered in Fall of odd years.
- 252. **Grain and Special Crops.** I. 3 hr. PR: Plant Sci. 52 and Agron. 2, or consent. Advanced study of methods in the production of grain and special crops. Varieties, improvement, tillage, harvesting, storage, and uses of crops grown for seed or special purposes. Offered in Fall of even years.
- 254. **Pasture and Forage Crops.** II. 4 hr. PR: Plant Sci. 52 and Agron. 2, or consent. All phases of pasture and forage crop production, including identification, seeding, management, use, seed production, and storage of forage crops. 3 lec., 1 lab.

Agronomy (Soil Science)

- 210. **Soil Fertility.** I. 3 hr. PR: Agron. 2 or 10. Soil properties in relation to fertility and productivity of soils; evaluation of soil fertility; production of fertilizers and their use in increasing the fertility and productivity of soils.
- 212. **Soil Conservation and Management.** II. 3 hr. PR: Agron. 2 or 10. Using soil technology to solve soil management problems relating to cropping systems. Field diagnosis of soil problems will be stressed. Two half-day visits. Offered in Spring of odd years.
- 230. **Soil Physics.** II. 3 hr. PR: Agron. 2 or 10. Physical properties of soils, water and air relationships and their influence on soil productivity. Offered in Spring of even years. 2 lec., 1 lab.
- 301. **Geotechnic.** I. 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. This course will serve as a common meeting ground for students in the various disciplines concerned with earth science. 3 lec. Offered in the Fall of odd years.
- 315. **Soil Genesis and Classification.** I. 3 hr. PR: Agron. 2 or 10. Origin and formation of soils. Study of soil profiles and soil forming processes in the field and laboratory. Principles of classification and techniques of soil mapping. 2 lec., 1 lab. Offered in Fall of even years.

321. **Identification of Clay Minerals in Soils.** II. 3 hr. PR: Physical Chemistry or consent. Characterization of clay minerals is becoming an important aspect of research and practical application in the areas of soil, geology, civil engineering, and related fields. This course will provide a vehicle for these various disciplines to study the methods used in qualitative and quantitative identification of these secondary minerals. 1 lec., 2 lab. Offered in Spring of even years.
410. **Advanced Soil Fertility.** II. 3 hr. PR: Agron. 210, Biol. 169 or consent. The influence of soil chemical and physical properties or availability of plant nutrients, intensive study of individual plant nutrients; and interactions of nutrients in soils and crops. Offered in Spring of odd years.
416. **Soil Chemistry.** I. 3 hr. PR: Consent. Chemistry of soil development; chemical and mineralogical composition of soils; nature and properties of organic and inorganic soil colloids; soil acidity; cation and anion exchange phenomena; soil chemistry of macro- and micro-nutrients.
418. **Chemistry of Soil Organic Matter.** II. 3 hr. PR: Agron. 210 or consent. The chemical composition of soil organic matter will be studied in relation to its physico-chemical properties and humus formation. Methods involving extraction, fractionation, and purification of soil organic components will be examined. 2 lec., 1 lab. Offered in Spring of even years.

Agronomy (Crop and Soil Science)

420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
450. **Seminar.** I, II. 1 hr. per sem. Recent literature pertaining to soil and crop production.
497. **Research.** I, II. 1-15 hr.

Genetics

Genet.

290. **Crop Breeding.** II. 3 hr. PR: Genet. 171 or 321. Methods and basic scientific principles involved in the improvement of leading cereal and forage crops through hybridization and selection. Offered in Spring of odd years.
321. **Basic Concepts of Modern Genetics.** I. 3 hr. PR: 8 hr. of biological science and 1 year of chemistry. Independent inheritance, linkage. Chemical nature of genetic material. Control of phenotype by genetic material. Gene action and coding of genetic material.
324. **Cytogenetics.** II. 4 hr. PR: Genet. 171 or 321, and Biol. 215 or consent. Emphasis is put upon macromolecules that carry information of the chromosomes, cell division, and the cytological and molecular basis of genetics. Special attention is given to cytogenetics of genomes and chromosome morphology and the evolution of these. Offered in Spring of odd years.
325. **Human Genetics.** I. 3 hr. PR: Genet. 171 or 321 or consent. A study of the genetic system responsible for the development of phenotype in man.
335. **Population Genetics.** I. 3 hr. PR: Genet. 171 or 321, or consent. The relationship of gene and genotype frequencies in populations of diploid organisms, and the effects of mutation, migration, selection, assortive mating, and inbreeding, in relation to single gene pairs. Application of these concepts to the multigenic inheritance of quantitative traits. Offered in Fall of even years.

390. **Genetic Mechanisms of Evolution.** II. 2 hr. PR: Genet. 171 or equiv. The genetic mechanisms which result in evolutionary change. The origin of life, origin and organization of genetic variability, differentiation of populations, isolation and speciation role of hybridization and polyploidy, and origin of man. Offered in Spring of even years.
420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
426. **Advanced Biochemical Genetics.** II. 3 hr. PR: Genet. 171 or 321 and Organic Chemistry. Physiological and biophysical concepts of genetic material. Structure and arrangement of genetic units. Nucleic acids as carriers of genetic information. Gene action and amino acid coding. Biochemical evolution of genetic material. Genetic control mechanisms. Biochemistry of mutation. Offered in Spring of even years.
450. **Seminar.** I, II. 1 hr. per sem. Recent literature pertaining to biochemical, classical, human, molecular and cytological genetics.
497. **Research.** I, II. 1-15 hr.

Horticulture

Hort.

204. **Plant Propagation.** II. 3 hr. A study of the practices of plant propagation and the factors involved in reproduction in plants.
229. **Landscape Design.** I. 3 hr. (1 lec., 1 scheduled lab., 1 arranged lab.). A course in ornamental horticulture giving an appreciation of the basic principles of design and information pertaining to the use and care of ornamental plants around the home.
242. **Small-Fruits.** I. 3 hr. (2 lec., 1 scheduled lab.). PR: Plant Sci. 52, Hort. 107, or consent. The taxonomic, physiological, and ecological principles involved in the production and handling of small-fruits.
243. **Physiology of Vegetables.** I. 3 hr. (2 lec., 1 scheduled lab.). PR: Plant Sci. 52. Physiological and ecological principles involved in the production of vegetable crops.
244. **Handling and Storage of Horticultural Crops.** II. 3 hr. (2 lec., 1 scheduled lab.). PR: Plant Sci. 52, Chem. 16. Characteristics of perishable crops. Methods and materials employed to maintain quality.
245. **Greenhouse Management.** II. 3 hr. The greenhouse as a controlled plant environment. A study of how to manipulate factors influencing plant growth and development within the specialized environments of greenhouses.
301. **Post-Harvest Physiology.** II. 3 hr. (1 lec., 2 labs.). Physiology and biochemistry of harvested crops.
420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
450. **Seminar.** I, II. 1 hr. (1 seminar). Recent literature in the plant sciences which pertains to horticultural science.
497. **Research.** I, II, S. 1-15 hr.

Entomology

Ent.

- 204. **Principles of Entomology.** I. 4 hr. PR: Biol. 1 and 2 or equiv. A basic course dealing with the morphology, physiology, reproduction, systematics, ecology, and control of insects.
- 420. **Special Topics.** I, II, S. 2-6 hr. PR: Ent. 204 or equiv., or consent. Advanced study of entomological topics of special interest or need to the student.
- 450. **Seminar.** I, II. 1 hr. per sem.
- 497. **Research.** I, II, S. 1-15 hr.

Agricultural Bacteriology

Agr. Bact.

- 347. **Food Microbiology.** I. 4 hr. PR: Bact. 141, organic chemistry or consent. The ecology and physiology of microorganisms important in the manufacture and deterioration of foods, and the techniques for the microbiological examination of foods. Offered in Fall of even years.
- 348. **Sanitary Bacteriology.** I. 3 hr. PR: Bact. 141. Standard bacteriological methods used in routine examination of water and sewage. Offered in Fall of odd years.
- 414. **Soil Microbiology.** II. 4 hr. PR: Bact. 141 and organic chemistry. Occurrence and distribution of microorganisms in soils and their interrelationships. Their role in decomposition of organic matter and other transformations of soil constituents. Offered in Spring of odd years.
- 420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
- 450. **Seminar.** I, II. 1 hr. per sem.
- 497. **Research.** I, II, S. 1-15 hr.

Plant Pathology

Plant Path.

- 201. **General Plant Pathology.** I. 4 hr. PR: Bact. 141. Nature and causes of plant diseases; methods of control.
- 301. **Diseases of Economic Plants.** I, II, S. 1-3 hr. per sem., 2 hr. in summer. PR: Plant Path. 201 and 303 or consent. Recognition, cause, and control of diseases of economic plants; Sem. I, Diseases of vegetable crops and of tree and small fruits; Sem. II, Diseases of ornamental plants and field and forage crops. S, Diseases of forest trees. Students may register for 1-3 hr. in Sem. I and II, 2 hr. in Summer, until 8 hours of credit are accumulated. Offered in 1971-72 and in alternate years.
- 302. **Principles of Plant Pathology.** \II. 4 hr. PR: Bact. 141 and either Plant Path. 152, 201, or 303, or consent. Primarily for graduate students and seniors majoring in botany, biology, or agricultural science. Nature of disease in plants with practice in laboratory methods. Offered in Spring of even years.
- 303. **Mycology.** I. 4 hr. Lectures, field and laboratory studies of parasitic and saprophytic fungi.

309. **Nematology.** II. 3 hr. PR: Plant Path. 201 or consent. Primarily for graduate students majoring in the agricultural sciences or biology. Nematode taxonomy, bionomics, and control, with particular emphasis on plant parasitic forms. Offered in Spring of odd years.
402. **Physiology of Plant Diseases.** I. 2 hr. PR: Agr. Biochem. 291 and Plant Path. 302, or consent. A study of host-parasite interactions, with emphasis on the physiological and biochemical changes that occur in higher plant tissues in response to pathogenic organisms. Offered in Fall of even years.
420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; max. credit, 6 hr.).
430. **Physiology of the Fungi.** II. 4 hr. PR: Organic chem., mycology, and bact., or consent. Physiological aspects of growth, reproduction, and parasitism of fungi, with emphasis on nutrition, environment, and other biotic factors.
440. **Taxonomy of the Fungi.** S. 3 hr. PR: Plant Path. 303. Collection and identification of fungi with emphasis upon those of economic importance. Offered in Summer of odd years.
450. **Seminar.** I, II. 1 hr. per sem.
497. **Research.** I, II, S. 1-15 hr.

DIVISION OF RESOURCE MANAGEMENT

The Division is composed of four committees: Agricultural Economics, Agricultural Education, Agricultural Engineering, and Landscape Architecture. The graduate program for Agricultural Engineering is listed under the College of Engineering, and currently there are no graduate degree programs in Agricultural Mechanics or Landscape Architecture. Graduate courses in Agricultural Mechanics and Landscape Architecture are offered to service the needs of students who are seeking their Master of Science degree in other fields or those who are candidates for the Master of Agriculture degree. There is a Division Admissions Committee and this committee reviews and evaluates all applications to do graduate work in the division.

Agricultural Economics

The faculty in Agricultural Economics offers major work for the degree of Master of Science in Agricultural Economics. Economics and Agricultural Economics faculties cooperate in offering a Ph.D. degree in Economics. For details on this degree, see the College of Business and Economics section.

The Degree of Master of Science

Students are urged to seek approval from the Admissions Committee of one of the options listed below at the time they begin work. In all cases, approval must be obtained before com-

pletion of 18 hours of course work. Students expecting to become professional agricultural economists or who hold research assistantships should seek approval of Option A. Those intending to pursue careers in agricultural business may seek approval of Option B.

Requirements for Admission

Students may be accepted for graduate study in Agricultural Economics on a regular or probationary basis. Students meeting all of the following requirements are admitted as regular students:

1. A bachelor's degree.
2. Twelve or more semester credits in economics, agricultural economics, statistics, or appropriate social science courses.
3. A grade-point average of 2.5 for all credit in economics and agricultural economics.

Students not meeting the above minimum requirements may petition for admission on a probationary basis. The Admissions Committee will set requirements for removing probationary status in each case. Failure of a student to fulfill the terms of his probation shall result in automatic suspension.

Students requesting transfer of graduate credit from courses outside Agricultural Economics must obtain approval of the Admissions Committee for such transfer and the average for such courses transferred must be no less than 2.5. Such petitions must include all courses appropriate to the degree; courses with low grades will not be omitted.

Options of Study

A. Thesis Option—A minimum of 30 credit hours of approved work to include not more than 6 hours of credit for the thesis, and enough courses to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

B. Course-Work Option—A minimum of 36 credit hours of approved course work to provide proficiency in economics and agricultural economics. Courses in closely related social sciences may be included.

Standards of Achievement

A minimum grade-point average of 3.0 is required for all graduate credit courses taken as part of the approved program for this degree. This includes graduate credit transferred from within the University and graduate credit accumulated while pursuing a degree in Agricultural Economics.

Students who have earned a grade-point average of 2.75 or more with 12 or more hours of graduate credit will be admitted

to candidacy. Those who do not attain this level will be placed on probation.

Examinations

Thesis Option. Satisfactory completion of an oral examination and, at the discretion of the student's graduate committee, a written examination.

Course-Work Option. Satisfactory completion of a written and an oral examination.

Agricultural Economics*

Agr. Econ.

- 200. **Land Economics.** II. 3 hr. Classification, development, tenure, use, conservation, valuation, and taxation of rural, urban, mineral, forest, water, and recreational land resources. Private and public rights in land and the affect of population on the demand for land.
- 206. **Farm Planning.** I. 3 hr. PR: Senior standing. Principal factors influencing returns on farms; planning use of labor, soil, crops, livestock, buildings and equipment. Farm visits required.
- 213. **Economic Development.** I or II. 3 hr. A comprehensive study of the problems, changes, and principal policy issues faced by non-industrialized countries in the process of economic development. This is a dual listing with Economics 213. Students who elect Agr. Econ. 213 may not receive additional credit for Economics 213.
- 231. **Marketing Agricultural Products.** II. 3 hr. Market organization, market policies and practices and factors affecting the marketing of agricultural products. Tour of market agencies and facilities in Pittsburgh area required.
- 235. **Marketing Dairy Products.** II. 2 hr. Milk marketing policies and practices, including milk-market orders. Offered in Spring of odd years.
- 240. **Agricultural Prices.** II. 3 hr. An analysis of the price-making forces which operate in the market places for the major agricultural commodities. Tour of market agencies and facilities in Pittsburgh area required.
- 261. **Agribusiness Finance.** I. 3 hr. Credit needs for agricultural businesses, financing farm and market-agency firms, and organization and operation of credit agencies which finance agricultural business firms. Offered in Fall of odd years.
- 271. **Agricultural Policy.** II. 3 hr. An examination of the economic aspects of governmental price programs, production and marketing controls, subsidies, parity, export and import policies, and other programs affecting agriculture. Offered in Spring of even years.
- 330. **Cooperative Organization.** II. 3 hr. Organization, functions, and contributions of cooperatives in an economic system. Offered in Spring of even years.
- 342. **Advanced Agricultural Economics.** II. 3 hr. Offered in Fall of even years.

*Economics 52 or equivalent is required as a prerequisite for all graduate courses offered in Agricultural Economics.

355. **Resource Analysis.** I. 3 hr. PR: Senior standing. Construction of models consistent with economic reality for allocating the factors of production available on farms, in forests, and in non-farm agricultural businesses to produce profit maximizing plans through the use of linear and dynamic programming and electronic equipment.
420. **Special Topics.** I, II, S. 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.)
431. **Advanced Agricultural Marketing.** II. 3 hr. PR: Consent. Structure of agricultural marketing; economic theory as applied to agricultural marketing with emphasis on theoretical and practical applications.
440. **Advanced Farm Management.** I. 3 hr. Offered in Fall of odd years.
441. **Production Economics.** II. 3 hr. PR: Consent. Economic principles of production with special application to agriculture. Offered in Spring of odd years.
450. **Seminar.** I, II. 1 hr.
497. **Research.** I, II, S. 1-15 hr.

Agricultural Education

Candidates for the Master of Science degree with a major in Agricultural Education must have done satisfactory work as undergraduates. The student's candidacy must be approved by the Admissions Committee. Candidates for the master's degree in agricultural education must have fulfilled the requirements for B.S. Agr. at West Virginia University or at an approved institution offering an equivalent degree. Also, the candidate must have completed a minimum of 20 hours in education and 45 hours in agriculture.

Students shall combine graduate courses in agriculture and in education by taking 16 to 20 hours in agriculture and 10 to 14 hours in education. A minimum of 5 hours shall be in professional courses dealing with agricultural education. All graduate courses offered toward a degree must be approved by the student's major adviser. The student and his major adviser shall arrange a specific curriculum to be pursued for the degree at the beginning of the graduate program. A thesis or problem is required as a part of the 30 hours of graduation.

Students shall complete in residence 15 hours of course work after having completed one or more years of teaching vocational agriculture. This shall apply unless the student has been granted permission by the Admissions Committee to complete his graduate work without teaching experience.

Agricultural Education

Agr. Educ.

260. **Principles of Cooperative Extension.** I. 2 hr. PR: Consent. Background, philosophy, and history of cooperative extension. Activities of county

cooperative extension agents and cooperative extension programs in West Virginia. Offered in Fall of even years.

261. **Method and Materials in Extension Education.** II. 2 hr. PR: Consent. Organization and preparation for extension teaching and the processes of communication. Offered in Spring of odd years.
263. **Teaching Young, Adult Farmer, and Off-Farm Agricultural Occupations Classes.** I. 2 hr. PR: Ed. Psych. 105, 106 or consent. Participation in conducting young, adult farmer, and off-farm agricultural occupations classes and school-community food preservation center; organization, course of study, method in teaching, and supervision of the classes, young farmers' association, adult farmers' organization, and off-farm agricultural occupations organizations in classes.
320. **Special Topics.** I, II, S. 1-4 hr. (For the Master's Degree, Special Topics ordinarily may count for 2 to 4 hr.; maximum credit, 6 hr.).
362. **Program Building in Cooperative Extension.** II. 3 hr. PR: Consent. Organization in relation to program building. Leadership and group action. Over-all working and educational objectives, principles, method, and goals in developing county extension programs. Offered in Spring of even years.
364. **Organizing and Directing Supervised Farming and Supervised Occupational Experience Programs.** S. 2 hr. PR: Ag. Ed. 160 or consent. Planning programs of supervised farming and supervised occupational experience, supervising and evaluating such programs for day students, young, adult farmer, and off-farm agricultural occupations classes and groups.
460. **Planning Programs and Courses for Vocational Agriculture Departments.** S. 2 hr. PR: Ag. Ed. 160, 188. Gathering data, studying the farming and off-farm agricultural occupations problems of day students, young farmers, adult farmers, and off-farm agricultural occupations groups and formulating total programs for school communities. (Also listed as C & I 460).
461. **Seminar.** S. 1 hr.
497. **Research.** I, II, S. 1-15 hr.

Agricultural Mechanics

Agr. Mech.

253. **Advanced Farm Machinery.** II. 3 hr. Performance of agricultural equipment including calibration, efficiency, adjustments, and maintenance. Theoretical and practical aspects of selection based on economics, compatibility of machines with other equipment and the farming operation, service, and factors of custom operation. 2 hr. rec., 3 hr. lab.
259. **Farm Structures.** II. 3 hr. Fundamentals of construction, functional requirements, materials, new equipment, and use of laborsaving ideas and machinery. 2 hr. rec., 3 hr. lab.
270. **Electricity in Agriculture.** II. 3 hr. The study of the fundamentals of electrical energy and its application to lighting, power, heating, and control circuits used in agriculture. 2 hr. rec., 3 hr. lab.

- 275. **Agricultural Engines. I.** 3 hr. Relation of theory to design and operation of internal combustion engines with emphasis on care, operation, and maintenance. Study covers one, two, three, four, six, and eight cylinder engines, both in two and four stroke designs. 2 hr. rec., 3 hr. lab.
- 352. **Advanced Farm Mechanics. II.** 3 hr. PR: Agr. Mech. 152. Forging, cold-iron work, tool fitting, woodworking. Offers training for teaching shop work in rural high schools. 1 hr. rec., 6 hr. lab.
- 420. **Special Topics. I, II, S.** 2-4 hr. (For the Master's Degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 497. **Research. I, II, S.** 1-15 hr.

Landscape Architecture

L.A.

- 248. **Design Analysis. II.** 2 hr. PR: Consent. Analysis of planning and design projects with respect to offering solutions to a given problem. Offered in Spring of odd years.
- 250. **Landscape Architectural Design. I.** 5-7 hr. PR: L.A. 151 and/or consent. Advanced design, a continuation of L.A. 150 and 151 with more comprehensive problems and in-depth collaborative study.
- 251. **Landscape Architectural Design. II.** 7 hr. PR: L.A. 250 or consent. Advanced comprehensive design problems, continuing L.A. 250 theme, but generally requiring individual work.
- 265. **Regional Design. I.** 3 hr. PR: Consent. Consideration of regional landscapes in order to effectively relate design to the ecology and development of a region. Offered in Fall of odd years.
- 276. **Recreation Planning. I.** 3 hr. PR: Consent. Design of park and recreation areas involving park history, classification theory, and administration.
- 284. **Professional Practice. II.** 2 hr. PR: Consent. The profession of landscape architecture involving the procedures in the preparation of contract documents, fees, estimates, operation of an office, and the relationship to clients and contractors. Offered in Spring of even years.

College of Arts and Sciences

BIOLOGY

The Department of Biology offers work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy in Biology. The department has certain requirements in addition to those of the Graduate School. Current information concerning the graduate programs of the department should be acquired by writing the Chairman, Department of Biology, before seeking admission to the Graduate School. Students may enroll in graduate courses and may work toward an advanced degree only with the approval of the department.

Applicants are expected to have a broad foundation of training in biology and related sciences, particularly chemistry, mathematics, and physics. The applicant is also expected to present Graduate Record Examination scores and three letters of recommendation for evaluation. Deficiencies in undergraduate training may prolong the required program for advanced degrees.

A summer field station, The Terra Alta Biological Station located at Terra Alta, Preston County, offers two summer sessions for course work and research. Write to TABS, Department of Biology, for descriptive folder.

Course offerings are subject to change.

Laboratory Fees

A nonrefundable fee is required of students taking the following laboratory courses in Biology:

Course	Per Sem.	Course	Per Sem.
Biol. 211.....	\$12.00	Biol. 266	\$ 8.00
Biol. 215.....	8.00	Biol. 267.....	12.00
Biol. 243.....	8.00	Biol. 269.....	12.00
Biol. 246.....	8.00	Biol. 345.....	8.00
Biol. 253.....	8.00	Biol. 348.....	4.00
Biol. 255.....	8.00	Biol. 351.....	8.00
Biol. 256.....	4.00	Biol. 352.....	8.00
Biol. 257.....	8.00	Biol. 354.....	8.00
Biol. 259.....	8.00	Biol. 355.....	8.00
Biol. 261.....	12.00	Biol. 356.....	8.00
Biol. 262.....	12.00	Biol. 360.....	8.00
Biol. 263.....	8.00	Biol. 434.....	4.00
Biol. 265.....	12.00		

Biology

Biol.

201. **History of Biology.** I. 3 hr. PR: Biol. 1 and 2 or equiv. History of the development of biological knowledge, with philosophical and social backgrounds.

209. **Topics and Problems in Biology.** I, II, S. 1-4 hr. PR: Consent. Topics and problems in contemporary biology. All topics or problems must be determined in consultation with the instructor.
211. **Life Cycle of the Cell.** I. 4 hr. PR: Biol. 1 and 2 or equiv., Biol. 104, Chem. 238, and Physics 2. Advanced study of fundamental cellular activities and their underlying molecular processes.
215. **Cytology.** II. 4 hr. PR: Biol. 1 and 2 or equiv. Cells, their structure and function.
231. **Behavior of Organisms.** I. 3 hr. PR: Biol. 1 and 2 or equiv. Principles of individual and group behavior.
243. **Plant Ecology.** I. 4 hr. PR: Biol. 1 and 2 or equiv. Environmental and ecological relationships of plants.
246. **Limnology.** I. 4 hr. PR: Biol. 103 or consent. Physical, chemical, and biological characteristics of inland waters with an introduction to the principles of biological productivity.
251. **Principles of Evolution.** I, S. 3 hr. PR: Biol. 1 and 2 or equiv. Introduction to the study of evolution.
252. **Flora of West Virginia.** II, S. 3 hr. PR: Biol. 1 and 2 or equiv. Consideration of the native plant life of the state.
253. **Plant Anatomy.** I. 4 hr. PR: Biol. 1 and 2 or equiv. Anatomy of seed plants.
254. **Plant Geography.** II, S. 3 hr. PR: Biol. 1 and 2 or equiv. Study of plant groupings and worldwide distribution of plants.
255. **Invertebrate Zoology.** II. 4 hr. PR: Biol. 1 and 2 or equiv. Advanced study of animals without backbones.
256. **Ornithology.** II. 3 hr. PR: Biol. 1 and 2 or equiv. Field and laboratory studies on the identification, migration, protection, nesting, and food habits of birds.
257. **Ichthyology.** II. 3 hr. PR: Biol. 101 or consent. Internal and external structure of fishes, their systematic and ecological relationships, and their distribution in time and space.
259. **General Parasitology.** I. 4 hr. PR: Biol. 1 and 2 or equiv. Introduction to the biology of parasites.
261. **Comparative Anatomy.** I. 5 hr. PR: Biol. 1 and 2, 101 or equiv. A comparative study of the morphology of selected vertebrates emphasizing functional and evolutionary relationships.
262. **Vertebrate Embryology.** II. 5 hr. PR: Biol. 1 and 2, 101 or equiv. Experimental and descriptive approach to the study of the development of vertebrates.
263. **Vertebrate Microanatomy.** II. 4 hr. PR: Biol. 101 or 261 and consent. The structural and functional approach of the tissues and organs of vertebrates.
264. **Comparative Developmental Anatomy.** II. 3 hr. PR: Biol. 261. Anatomy and development of the organs and systems of various vertebrates.
265. **Comparative Neuroanatomy.** II. 4 hr. PR: Biol. 101 or 261 and consent. Comparative study of development and anatomy of the nervous systems of the vertebrates.
266. **Human Physiology.** I, II, S. 4 hr. PR: Biol. 1 and 2 or consent. An introductory course in the functions of man.

267. **Comparative Physiology.** II. 4 hr. PR: Biol. 101 or 266, or equiv. Study of the diverse ways in which different kinds of animals meet their functional requirements.
268. **Physiology of the Endocrines.** I. 3 hr. PR: Biol. 101 or 266, or equiv., organic chemistry or consent. Regulation of the organs of internal secretions and mechanisms of action of the hormones produced.
269. **Physiology of the Endocrines—Laboratory.** I. 1 hr. PR or Conc.: Biol. 268. Experimental techniques used in study of the endocrine system.
268. **Physiology of the Endocrines.** I. 4 hr. PR: Biol. 101 or 266, or equiv., organic chemistry or consent. Regulation of the organs of internal secretion, mechanisms of action of the hormones, and experimental techniques used in study of the endocrine system.
309. **Topics in Biology.** I, II, S. 1-4 hr. PR: Consent. Topics in contemporary biology. Topic will be selected by the instructor for formal presentation.
311. **Biology Seminar.** I, II. 1 hr. Discussions and presentations of general interest to biologists.
313. **Problems in Biology.** I, II, S. 1-4 hr. per sem. PR: Consent. Problems in contemporary biology. Selection of topics to be determined in consultation with the instructor.
314. **Topics in Cellular and Molecular Biology.** I, II, S. 1-4 hr. PR: Consent. Topics in contemporary cellular and molecular biology. Topic will be selected by the instructor for formal presentation.
316. **Seminar in Cellular and Molecular Biology.** I, II. 1 hr. Selected areas of cellular and molecular biology are presented and discussed.
322. **Topics in Bioscience Education.** I, II, S. 1-4 hr. PR: Consent. Topics in contemporary biology. Topic will be selected by the instructor for formal presentation.
323. **Seminar in Bioscience Education.** I, II. 1 hr. Selected areas of bioscience education are presented and discussed.
333. **Behavioral Ecology.** II. 4 hr. PR: Biol. 103 and 231 or consent. A discussion of the influences of the external environmental factors on the regulation and control of behavior.
338. **Seminar in Animal Behavior.** I, II. 1 hr. Selected areas of animal behavior are presented and discussed.
339. **Problems in Animal Behavior.** I, II, S. 1-4 hr. PR: Consent. Problems in contemporary animal behavior. Selection of topics to be determined in consultation with the instructor.
343. **Plant Communities.** S. 3 hr. PR: Biol. 1 and 2 or equiv. Field studies in the plant ecology of the central Appalachians.
345. **Fisheries Science.** II. 4 hr. PR: Biol. 257 or consent. Population dynamics in relation to principles and techniques of fish management.
346. **Dynamics of Ecosystems.** II. 3 hr. PR: Biol. 103 or consent. Modern concepts in ecology covered through discussion of readings. Topics treated are selected from the areas of population genetics, energy flow, nutrient cycling, and community structure.
347. **Seminar in Ecology.** I, II. 1 hr. Selected areas of ecology are presented and discussed.
348. **Topics in Ecology.** I, II, S. 1-4 hr. PR: Consent. Topics in contemporary ecology. Topic will be selected by the instructor for formal presentation.
349. **Problems in Ecology.** I, II, S. 1-4 hr. PR: Consent. Problems in contemporary ecology. Selection of problems to be determined in consultation with the instructor.

350. **Biosystematics.** I. 3 hr. PR: Biol. 1 and 2 or equiv. The techniques, history, and principles of the systematics of plants and animals.
351. **Plant Morphology (Algae and Fungi).** I. 4 hr. PR: Biol. 1 and 2 or equiv. Development and structure of algae and fungi.
352. **Plant Morphology (Bryophytes and Vascular Plants).** II. 4 hr. PR: Biol. 1 and 2 or equiv. Development and structure of bryophytes and vascular plants.
353. **Taxonomy of Vascular Plants.** S. 3 hr. PR: Biol. 1 and 2 or equiv. Field studies in the taxonomy of higher plants.
354. **Fresh-Water Algae.** I. 4 hr. PR: Biol. 1 and 2 or equiv. Taxonomy, cytology, and ecology of aquatic, aerial, and land forms of fresh-water algae.
355. **Advanced Plant Systematics I.** I. 3 hr. PR: Biol. 151 or equiv. Taxonomy of pteridophytes, gymnosperms, and monocotyledons.
356. **Advanced Plant Systematics II.** II. 3 hr. PR: Biol. 151 or equiv. Taxonomy of dicotyledons.
357. **Aquatic Seed Plants.** I. 3 hr. PR: Biol. 1 and 2 or equiv. Classification, ecology, and economic importance of aquatic seed plants.
358. **Field Studies of Invertebrates.** S. 3 hr. PR: Biol. 1 and 2 or equiv. Taxonomy and ecology of the invertebrates.
359. **Field Studies of Vertebrates.** S. 3 hr. PR: Biol. 1 and 2 or equiv. Taxonomy and ecology of the vertebrates.
360. **Vascular Cryptogams.** II. 4 hr. PR: Biol. 1 and 2 or equiv. Taxonomy, anatomy, cytology, and ecology of the club mosses, horsetails, and ferns.
362. **Developmental Biology.** I. 4 hr. PR: Biol. 101, 102, 262 or equiv. and Organ. Chem. The molecular and cellular basis of differentiation and morphogenesis.
364. **Advanced Plant Physiology.** I, II. 3 hr. PR: Biol. 169 or equiv., organic chemistry, general physics, and consent. Advanced studies of plant processes including recent advances in the field. I. Spring semester, odd-numbered years—Water relations and mineral nutrition and translocation. II. Fall semester, odd-numbered years—Plant growth and development. III. Spring semester, even-numbered years—Environmental physiology.
366. **Plant Development.** II. 4 hr. PR: Biol. 102, Organic Chem. or Biochem. Experimental studies of plant growth and developments.
367. **Topics in Developmental Biology and Physiology.** I, II, S. 1-4 hr. PR: Consent. Topics in contemporary developmental biology and physiology. Topics will be selected by the instructor for formal presentation.
368. **Problems in Developmental Biology and Physiology.** I, II, S. 1-4 hr. PR: Consent. Problems in contemporary developmental biology and physiology. Selection of problems to be determined in consultation with the instructor.
369. **Seminar in Developmental Biology and Physiology.** I, II. 1 hr. Selected areas of developmental biology and physiology are presented and discussed.
390. **Seminar in Systematic and Evolutionary Biology.** I, II. 1 hr. per sem. PR: Consent. Selected areas of systematic and evolutionary biology are presented and discussed.

391. **Topics in Systematics.** I, II, S. 1-4 hr. PR: Consent. Topics in contemporary systematics. Topic will be selected by the instructor for formal presentation.
411. **Problems in Cellular and Molecular Biology.** I, II, S. 1-4 hr. PR: Consent. Problems in contemporary cellular and molecular biology.
443. **Advanced Plant Ecology.** II. 2-4 hr. PR: Biol. 103 and 243 or equiv. Advanced field studies in plant ecology.
453. **Cytotaxonomy.** II. 3 hr. PR: Biol. 1 and 2, 151, Gen. 221, or consent. The determination of phylogenetic relationships by cytological and taxonomic methods.
454. **Mammalogy.** I. 3 hr. PR: Biol. 103 or equiv. The study of mammals and their biological properties with emphasis on the life history, ecology, and distribution of regional forms.
497. **Research.** I, II, S. 1-15 hr.

CHEMISTRY

The Department of Chemistry offers graduate studies leading to the degree of Master of Science and Doctor of Philosophy with research concentration in the areas of analytical, inorganic, organic, physical, and theoretical chemistry. Both of these degrees require completion of a research project which represents the principal theme about which the graduate program is constructed.

Applicants for graduate studies in chemistry must have as a minimum requirement a bachelor's degree with a major or concentration in chemistry and an appropriate background in physics and mathematics. All entering graduate students in chemistry are required to take Departmental Guidance Examinations in the major areas of chemistry. These examinations, on the undergraduate level, are administered prior to registration and serve to guide the faculty in recommending a course program for the beginning graduate student. Deficiencies revealed on the Guidance Examinations need to be corrected in a manner prescribed by the faculty.

The general Graduate School requirements for the Master of Science degree have been outlined elsewhere in this bulletin. Graduate students in the M.S. program in the Department of Chemistry are required to submit a research thesis and thus may enroll in a maximum of 6 hours of research. The remaining 24 hours of credit must be earned in the basic graduate courses which reflect a diversified exposure to chemistry; no more than 10 hours may be elected outside the Department of Chemistry. A final oral examination of the M.S. candidate is administered after completion and submission of the thesis.

The program for the degree of Doctor of Philosophy reflects a flexible, research-oriented approach geared to develop the interests, capability and potential of mature students. A program of courses is recommended to suit individual needs based on background, ability, and maturity. These courses are classified as basic graduate courses which present the essentials of a given discipline

on an advanced level, and specialized graduate courses which take one to the frontiers in a specific area of research. The course offerings are designed to provide guidelines from which graduate students can launch their independent studies in preparation for candidacy examinations. Students are required to enroll in the departmental seminar program and are expected to attend special lectures and seminars offered by visiting chemists.

All graduate students in the Ph.D. program are expected to achieve a certain diversified background in the major areas of chemistry. In order to aid in this achievement, a departmental distribution requirement of one three-hour credit course in each of the four major areas of chemistry selected from the following course offerings must be met: Analytical 211, 413, or 414; Inorganic 423, 424, or 426; Organic 331, 332, or 433; Physical 242, 341, or 443. In addition, each major area in chemistry requires students in that discipline to enroll in basic graduate courses which present the essentials of that discipline on an advanced level.

Candidacy examinations consist of both a written and oral portion. The written examinations are of the cumulative type, except in physical chemistry, and are offered eight times a year. The oral examination is based on a proposition for a research problem not intimately related to the student's own problem, or any particular research problem being actively pursued at West Virginia University. This proposition is presented in writing to the student's research committee and defended before that group and any other interested faculty members.

In the area of physical chemistry, the written examination is a comprehensive examination based on one year of graduate study in physical chemistry. The examination is given once each semester as necessary.

Completion of the language requirement, which must be taken in German unless prior approval for another language is obtained from the Department and the Dean of the Graduate School, and satisfactory completion of the candidacy examinations is required before a student is admitted to candidacy for the Ph.D. degree.

Research which is the major theme of graduate studies may be initiated as early as the student and faculty feel appropriate for each individual case. Normally a student will begin laboratory work during his first summer or in September of the following year. Upon successful completion of an original piece of research, the candidate will present his results in a Ph.D. dissertation and at the appropriate time defend his work in a final oral examination.

Details regarding the Graduate School requirements for the M.S. and Ph.D degrees and information about financial assistance available for graduate students in chemistry can be found in earlier portions of this bulletin. Additional questions on these matters may be directed to the Chairman of the Department of Chemistry.

Laboratory Fees

A nonrefundable fee is required of all students who register for the following laboratory courses in Chemistry:

Chem. 202	\$16.00	Chem. 220	\$16.00
Chem. 210	16.00	Chem. 235	16.00
Chem. 211	16.00	Chem. 239	16.00

Chemistry

Chem.

202. **Selected Topics.** I, II. 1-3 hr. PR: Written consent, with at least a 2.0 overall grade-point average and a 2.0 grade-point average in chemistry courses. Individual instruction under supervision of an instructor.
210. **Instrumental Analysis.** II. 3 hr. PR: Chem. 143 and 235. Basic instrumentation of analytical measurement. Electronics and instrument design. Methods of electrochemical and spectrochemical analysis. Two periods of lecture and one 3-hr. laboratory each week.
211. **Intermediate Analytical Chemistry.** I. 3 hr. PR: Chem. 210. Basic concepts of analytical procedures and separations at an advanced level. Two periods of lecture and one 3-hr. laboratory each week.
220. **Techniques of Chemical Syntheses.** II. 2 hr. PR or conc.: Chem. 222. Modern techniques involved in the preparation and handling of inorganic and organic materials. Inert atmosphere, vacuum system, high temperature and pressure, fractional crystallization, distillation, sublimation, chromatography, separation of isomers, non-aqueous solvents, microscopy and other special techniques. Two 3-hr. laboratories each week.
222. **Chemistry of Inorganic Compounds.** II. 3 hr. PR: Chem. 242. A correlation of the reactions and properties of elements and their compounds based on modern theories of chemical bonding and structure. Topics include acid-base theory, non-aqueous solvents, ligand field theory and stereochemistry. Three periods of lecture each week.
235. **Methods of Structure Determination.** I. 4 hr. PR: Chem. 134 and 136. Both chemical and physical methods are used to study unknowns. Application of physical methods (u.v., i.r., n.m.r., e.s.r., Raman and mass spectroscopy) to problems of organic chemistry with emphasis on structure elucidation. A practical course for students in chemistry and related fields who may need these methods in research and applied science. Two lectures and two 3-hour laboratories per week.
237. **Polymer Chemistry.** I or II. 3 hr. PR: Chem. 143 or concurrent enrollment or consent. The methods, mechanisms, and underlying theory of polymerization processes. The structure and stereochemistry of polymers in relation to chemical, physical, and mechanical properties. Lectures, 2-3 hours per week, accompanied by a laboratory designed to illustrate certain principles of polymerization processes and to demonstrate characteristic physical and chemical properties.
239. **Organic Syntheses.** II. 2 hr. PR: Chem. 136. Modern synthetic methods of organic chemistry. Two 3-hr. laboratories each week.
242. **Chemical Bonding and Molecular Structure.** I. 3 hr. PR: Chem. 144 and 210. An introduction to the quantum theory of chemical bonding. Atomic structure, spectroscopy, predictions of molecular structures and bond properties. Three periods of lecture each week.

243. **Introduction to Radiochemistry and Radiation Chemistry.** I. 3 hr. PR: Physical Chemistry or concurrent enrollment. An introduction to the basic fundamentals of radiochemistry and the use of tracer techniques in various disciplines, and an introduction to some aspects of radiation chemistry and how ionizing radiation interacts with matter. Two lectures and one 3 hr. laboratory each week.
244. **Colloid and Surface Chemistry.** II. 2 hr. PR: Physical Chemistry. Selected topics in the properties and physical chemistry of systems involving macromolecules, lyophobic colloids, and surfaces. Two periods of lecture each week.
245. **Crystallography.** I. 3 hr. PR: Physical Chemistry or concurrent enrollment, or consent. Applications of X-ray diffraction of crystals to the study of chemical and physical properties of matter. Includes theories of diffraction and crystallographic methods of analysis as applied to the study of molecular and crystal structures. Open to advanced students in chemistry, biochemistry, geology, physics and related fields. Three periods of lecture each week.
331. **Advanced Organic Chemistry I.** I. 3 hr. PR: Chem. 134. Structural concepts, localized and delocalized bonding, tautomerism, static and dynamic stereochemistry, mechanistic classifications of reagents and reactions including some applications. Three periods of lecture each week.
332. **Advanced Organic Chemistry II.** II. 3 hr. PR: Chem. 331. A continuation of Chem. 331 with emphasis upon synthetic methods and reaction mechanisms, including carbonium ions, carbanions, and free radical chemistry. Three periods of lecture each week.
341. **Chemical Thermodynamics.** II. 3 hr. PR: Chem. 144. Principles of classical and statistical thermodynamics and their application to chemical problems. Three periods of lecture each week.
- 411, 412. **Seminar in Analytical Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of analytical chemistry.
413. **Electrochemistry and Instrumentation.** II. 3 hr. PR: Chem. 210. Electronic instrumentation as applied to the study of mass transfer, kinetics of electrode reactions, voltammetry, and high-frequency methods. Three periods of lecture each week.
414. **Spectroscopic Methods.** I. 3 hr. PR: Chem. 210. Problems in the design of instruments for each of the various spectral regions. Three periods of lecture each week.
- 417, 418. **Advanced Topics in Analytical Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of analytical chemistry.
- 421, 422. **Seminar in Inorganic Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of inorganic chemistry.
423. **Advanced Inorganic Chemistry.** I. 3 hr. PR: Chem. 222. Advanced topics in modern inorganic chemistry including bonding theories, stereochemistry, non-aqueous solvent systems, physical methods and current topics. Three periods of lecture each week.
424. **Coordination Chemistry.** II. 3 hr. PR: Chem. 222, corequisite Chem. 242. Ligand field theory, spectral interpretations, stability considerations, synthetic methods, unusual oxidation states, organometallic compounds, other topics of current interest. Three periods of lecture each week.

425. **Inorganic Reactions and Mechanisms.** I or II. 2 hr. PR: Chem. 423, 424 and 443. A detailed study of substitution, isomerization, racemization, and oxidation-reduction reaction. Two periods of lecture each week.
426. **Chemistry of Non-Metals.** I or II. 2 hr. PR: Chem. 222. Electrodeficient compounds, sulfur-fluorine chemistry, inorganic polymers, rare gas compounds, solid-state chemistry of silicon and germanium, other topics of current interest. Two periods of lecture each week.
- 427, 428. **Advanced Topics in Inorganic Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of inorganic chemistry.
- 431, 432. **Seminar in Organic Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of organic chemistry.
433. **Physical Organic Chemistry.** I. 3 hr. PR: Chem. 331. Theoretical considerations of organic molecules, kinetics and other methods used in the study of organic structure and reaction mechanisms, linear free energy relationship and other related topics. Three periods of lectures each week.
436. **Heterocyclic Chemistry.** I or II. 3 hr. PR: Chem. 331. A systematic survey of the chemistry of the major heterocyclic systems and discussion of selected natural products containing heterocycles. Three periods of lecture each week.
- 437, 438. **Advanced Topics in Organic Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of organic chemistry.
- 441, 442. **Seminar in Physical Chemistry.** I, II. 1 hr. per sem. Current literature and research in the area of physical chemistry.
443. **Chemical Kinetics.** I. 3 hr. PR: Chem. 144. Theories and applications of kinetics in gaseous state and in solution. Three periods of lecture each week.
444. **Statistical Mechanics.** I or II. 3 hr. PR: Chem. 446. Theory and application of statistical mechanics to chemical systems. Three periods of lecture each week.
445. **Theoretical Chemistry I.** II. 3 hr. PR: Differential equations. Theoretical background for quantum mechanics. Three periods of lecture each week.
446. **Theoretical Chemistry II.** I. 3 hr. PR: Chem. 445. Theories and applications of quantum mechanics in chemistry. Three periods of lecture each week.
447. **Molecular Spectroscopy and Structure.** II. 3 hr. PR: Chem. 446. An advanced course in the application of spectral methods to a study of molecular structure. Three periods of lecture each week.
- 448, 449. **Advanced Topics in Physical Chemistry.** I, II. 1-3 hr. per sem. Recent advances and topics of current interest in the area of physical chemistry.
497. **Research.** I, II. 1-15 hr.

ENGLISH LANGUAGE AND LITERATURE

Admission: To be admitted to the Department of English as a prospective candidate for the degree of Master of Arts, a student is expected to have completed work comparable to the Depart-

ment's undergraduate requirement for English majors and to present a record distinctly above the average.

If as an undergraduate the applicant majored in English, the general average of grades in all English courses must be no lower than B. If the applicant's average in all English courses is lower than B, the Committee on Admissions may extend a "Probational Admission" for one semester, at the end of which the student's status will be determined by the Committee.

If as an undergraduate the applicant majored in a subject other than English, he will be admitted only on condition that he fulfill, to the extent of his particular deficiency, the normal course and credit obligations of the undergraduate English major at West Virginia University. Such an admission is termed a "Conditional Admission."

Course Requirements: A candidate for the M.A. degree will be expected to complete courses covering the major periods and the works of the major authors of English literature. The minimum requirement is 36 hours of graduate work.

Examinations: In addition to the final oral examination related particularly to the student's field of special interest as reflected in the master's thesis, a graduate student in English is required to take two three-hour comprehensive written examinations in English and American literature. The student will normally take these examinations in the semester or term following that in which he has established acceptable credit in 24 hours of graduate course work with an average of 3.0. The examinations will be conducted not later than four weeks before the last day of classes of a semester, or three weeks before the end of a summer term. With the permission of the Examining Committee, an unsuccessful candidate may be re-examined. Success in the examination admits the student to candidacy for a graduate degree.

Thesis: For students who have entered or may enter full graduate status in the Department prior to the first semester 1969-70, the writing of a thesis shall remain optional under the terms stated in the *Graduate School Announcements* for 1968-69. A student who entered in the fall of 1969 or later shall be required to write a thesis of a type and on a subject approved by the Department. The student will write under the supervision of a thesis adviser to be assigned. Information about the procedure and the dates for filing application for approval of projects, and about dates for submission of theses, is available at the office of the Department. The thesis may be a work of scholarship, of criticism, or of creative writing (original poetry, drama, or fiction).

The thesis shall count for six hours of graduate credit.

Foreign Language Requirement: A candidate for the degree of Master of Arts in English must have completed studies in a foreign language (preferably French or German) equivalent to 12 semester hours of college work. If an applicant does not meet

this requirement, he may prepare to meet it through independent study, or otherwise, in order to show a reading knowledge on examination.

English

201. **Creative Writing.** II. 3 hr. PR: English 101 and 102 or 103 or their equivalent, or by consent. An advanced workshop in creative writing, designed for students who are seriously engaged in the writing of a major work.
210. **Structure of the English Language.** I, II. 3 hr. A course in historical, comparative, and descriptive grammar, together with an introduction to English linguistics.
211. **History of the English Language.** I. 3 hr. A study of the nature of the language; questions of origins, language families, development, relationship of English as one of the Indo-European languages.
220. **American Poetry.** I. 3 hr. A study of the major American poets of the nineteenth and twentieth centuries—Bryant, Poe, Emerson, Longfellow, Whitman, Dickinson, Frost, Eliot. Primary emphasis on their poetry as poetry; background materials minimized.
230. **Modern American Biography.** I. 3 hr. A selection of the most significant and interesting biographies and autobiographies of Americans of distinction in literature, the arts, and public life.
231. **Modern British Biography.** II. 3 hr. Representative biographies and autobiographies of important British figures in public life and the arts, chosen for their literary value and their interest and relevance in contemporary life.
232. **Literary Criticism.** II. 3 hr. The history of literary criticism from Aristotle to modern times.
233. **Recent Literary Criticism.** I, II. 3 hr. A brief survey of the theories and essays of five major schools of modern criticism and an application of these theories to a novel, a play, and to selected poems and short stories.
234. **Modern Drama.** II. 3 hr. A study of world drama from Ibsen to the present day.
235. **American Drama.** I. 3 hr. A study of representative American dramas and of the history of the theatre in America.
236. **Tragedy.** II. 3 hr. Masterpieces of tragedy from Greek times to modern, with consideration of the changing concepts of tragedy and of the ethical and ideological values reflected in the works of major tragic authors.
240. **Folk Literature.** I. 3 hr. A study of the folk ballad, its origin, history, and literary significance, based on Child's collection and on American ballad collections.
241. **Folk Literature of the Southern Appalachian Region.** II. 3 hr. A study of the traditional literature of the people of the Southern Appalachian Region, including songs, prose tales, language, customs, based on material collected in the region, especially in West Virginia.
250. **Shakespearean Comedies and History Plays.** I. 3 hr. A study of representative comedies of Shakespeare against the background of classical and Renaissance theory and practice, and of selected history plays.

251. **Shakespearean Tragedy.** II. 3 hr. A study of the principal tragedies of Shakespeare, together with the history of criticism, scholarly investigation, and interpretation.
255. **Chaucer.** I. 3 hr. Early poems, *Troilus and Criseyde*, and *The Canterbury Tales*. In addition to an understanding and appreciation of Chaucer's works, the student is expected to acquire an adequate knowledge of Chaucer's language.
256. **Milton.** II. 3 hr. A study of all of Milton's poems and a few selected prose works.
261. **Sixteenth Century Prose and Poetry.** I. 3 hr. Studies from Caxton to Bacon, from Skeleton to Shakespeare.
262. **Seventeenth Century Prose and Poetry.** II. 3 hr. Studies from Donne to Dryden.
263. **Literature of the Eighteenth Century.** I. 3 hr. Literature of the period 1700-1750, studied in relation to the social, political, and religious movements of the time.
264. **Literature of the Eighteenth Century.** II. 3 hr. Continuation of English 263, covering the latter half of the century. May be taken independently of English 263.
265. **The Romantic Movement.** I. 3 hr. The works of Wordsworth, Coleridge, and Keats, together with an introduction to works of scholarship in the field of English Romanticism.
266. **American Romanticism.** II. 3 hr. The writing of Ralph Waldo Emerson, Henry David Thoreau, and Nathaniel Hawthorne. A study of the relations of these men to the history of their own time, and of their contributions to American thought and art.
267. **Victorian Poetry.** I. 3 hr. A study of the major Victorian poets—Tennyson, Browning, Arnold, Rossetti, Morris, Swinburne, and Fitzgerald, and a few of the later Victorian poets.
268. **Modern British Poetry.** I. 3 hr. A survey of British poetry from 1890 to the present, including the Decadents, Counter-Decadents, Hopkins, Housman, Hardy, the Georgians, the Imagists, and war poets; Yeats, Eliot, the Auden Group, and the post-World War II poets.
280. **Southern Writers.** II. 3 hr. Examination of twentieth-century Southern essayists, poets, short-story writers, and novelists in relation to the ideological background.
281. **Literature for Teachers.** S. 3 hr. Study and appreciation of selected works of American authors, with special reference to the high-school curriculum. Given usually in the Summer Session.
282. **Literature for Teachers.** S. 3 hr. Study and appreciation of selected works of English authors. Recommended for teachers of high-school English. Given usually in the Summer Session.
283. **Study of Selected Authors. (American).** I, II. 3 hr. A study of the works of a principal American author, or of more than one, as announced when the course is scheduled.
284. **Study of Selected Authors. (English).** I, II. 3 hr. Study of the works of one or more of the principal English authors, as announced in the schedule when the course is listed.
286. **Black American Fiction.** II. 3 hr. A survey of novels and short stories written by black Americans from 1890 to the present.

310. **Old English (I).** I. 3 hr. A study of Anglo-Saxon with selected readings from the literature of the period.
311. **Old English (II).** II. 3 hr. PR: English 310. **Beowulf** and other texts in Old English.
312. **Approaches to Teaching Composition.** S. 3 hr. This course surveys the attitudes toward and techniques of teaching writing in elementary and secondary schools. In addition, it provides frequent opportunities for students to write, to analyze their writing, and to experiment in class with various methods of teaching writing to children and young adults. Special attention is paid to formulating writing assignments and to devising effective methods of evaluation and grading.
330. **Early English Drama.** I. 3 hr. A study of the medieval and early Tudor drama, to the age of Shakespeare.
331. **Elizabethan Drama.** II. 3 hr. A study of the dramas of Shakespeare's contemporaries and successors to the closing of the theatres in 1642. Includes Kyd, Marlowe, Peele, Green, Jonson, Heywood, Marston, Chapman, Webster, Beaumont and Fletcher, Massinger, Ford, and Shirley.
332. **Restoration and Eighteenth Century Drama.** II. 3 hr. Comedy, tragedy, the heroic play, the drama of sensibility and the reaction against it: Etherege, Wycherley, Farquhar, Congreve, Vanbrugh, Dryden, Otway, Goldsmith, and Sheridan.
334. **Contemporary Drama.** II. 3 hr. Recent developments in the drama, with special attention to Miller, Williams, Sarter, Anavilk, Osborne, Pinter, Bolt, and the Absurdist. (The content of this course will be altered as new playwrights representing new developments come into prominence.)
335. **The English Novel to the Time of Scott.** I. 3 hr. A study of the English novel from the sixteenth century to the time of Scott, showing the development of the novelistic art from early narrative beginnings.
336. **The English Novel, 1832-1900.** II. 3 hr. A continuation of English 335. The development of the English novel from the early nineteenth century to the beginning of the twentieth century.
337. **The Modern Novel.** I. 3 hr. The twentieth-century novel, with emphasis upon the work of selected British novelists.
340. **The American Novel to 1915.** I. 3 hr. A history of the American novel, based on the reading of ten or twelve novels, from the beginning to the First World War.
341. **The American Novel, II.** II. 3 hr. A history of the American novel, based on readings of ten to twelve novels from the First World War to the present.
350. **Shakespeare.** I. 3 hr. Intensive study of selected plays. Special attention to textual problems and to language and poetic imagery, together with the history of Shakespearean criticism and scholarship.
355. **Spenser.** I. 3 hr. A study of Spenser's minor poems and **The Faerie Queene**; forms and sources, purpose of the great epic, social, political, and religious allegory.
356. **Byron and Shelley.** II. 3 hr. Reading and study of the works of two poets of the later Romantic Movement, together with works of criticism and scholarship related to the period.

365. **Victorian Prose, II.** 3 hr. A study of the non-fictional writings of the great Victorian prose critics: Carlyle, Ruskin, Arnold, Newman, Macaulay, Huxley, and Morris.
366. **English Literature, 1880-1918.** 3 hr. A study of the more important writers and literary movements of the late Victorian and the Edwardian periods with emphasis on Hardy, Housman, Hopkins, Henley, Pater, Gissing, Moore, Butler, and the writers of the "Aesthetic movement."
369. **American Literature to 1830. I.** 3 hr. A study of American literature and its informing cultural milieu and early national periods, 1607-1830.
370. **American Literature, 1830-65. II.** 3 hr. A study of the literature of the Romantic period in American literature, concentrating on Emerson, Thoreau, Poe, Hawthorne, and Melville.
371. **American Literature, 1865-1915. I.** 3 hr. A study of the literature of transcendentalism, realism, and naturalism in America between the Civil War and World War I, concentrating on Whitman, Mark Twain, Henry James, Emily Dickinson, Stephen Crane, Henry Adams, and Theodore Dreiser.
372. **American Literature, 1915-Present. II.** 3 hr. A study of American prose, poetry, and drama since 1915.
400. **Thesis. I, II.** 3 hr.
401. **Thesis. I, II.** 3 hr.
- 440, 441. **Medieval Literature. I, II.** 3 hr. each sem. PR: Graduate standing.
- 446, 447. **The Renaissance. I, II.** 3 hr. each sem. PR: Graduate standing. Literary and cultural influences from the Continent on the English literature of the late fifteenth and early sixteenth centuries. Discussion and analysis of major English literary works of the period.
- 450, 451. **English Drama to 1642. I, II.** 3 hr. each sem. PR: Graduate standing. A consideration of the varied aspects of English drama from its medieval beginnings to the middle of the seventeenth century. Discussion and analysis of selected dramas.
- 456, 457. **Folklore and Folk Literature. Seminar.** 3 hr. each sem. PR: Graduate standing. Research projects in folklore, including field work in collecting folklore in the Appalachian region and the analysis of the use of folklore in the works of British and American authors.
- 460, 461. **The Eighteenth Century. I, II.** 3 hr. each sem. PR: Graduate standing.
- 470, 471. **Romanticism. I, II.** 3 hr. each sem. PR: Graduate standing. Studies in major authors and special topics in the field of English Romanticism.
- 476, 477. **The Victorian Era. I, II.** 3 hr. each sem. PR: Graduate standing. Writers of the Victorian period considered in relation to the cultural matrix from which they rise. Particular attention is given to the varying intellectual currents of the era.
- 484, 485. **Seminar. I, II.** 3 hr. PR: Graduate standing. Seminar in principal authors and movements in American literature from the Colonial Period to 1870, with emphasis on topics and authors announced in the schedule.
- 486, 487. **American Literature, 1870-. I, II.** 3 hr. each sem. PR: Graduate standing. Literary and intellectual America from 1870 to 1914 in terms of leading literary men and changing cultural patterns of the period. Discussion and analysis of selected prose and poetic works.

492. **Introduction to Literary Research.** I, II. 3 hr. Bibliography; materials and tools of literary investigations; methods of research in various fields of literary history and interpretation; problem of editing. Practical guidance in the writing of theses.
494. **Seminar.** I, II. 2 or 3 hr. PR: Graduate standing. Specific authors to be approved by the instructor. A graduate study of particular periods of authors.
497. **Research.** I, II. 1-15 hr.

FOREIGN LANGUAGES

The Department of Foreign Languages offers graduate study in French, Spanish, German, Latin, and Greek literature and culture, in linguistics, in language teaching methods, and in bibliography and research. Candidates for the master's degree are accepted in French, Spanish, and German.

A student who wishes to do graduate work in this department should apply to the chairman of the department, who will act as his adviser until the student becomes a candidate for a graduate degree. An advisory committee will then be appointed to direct the student's work. Usually, he will be expected to have an undergraduate major in a foreign language, preferably the one in which he proposes to major. He should normally show an average of at least 3.0 (B) in his undergraduate foreign language courses.

A candidate must complete at least 36 graduate hours for a master's degree, 24 to 27 hours of which, including Bibliography and Research 265, will be in his major field. Prospective teachers are expected to complete Language Teaching Methods 421 as part of the work in the major fields. Six hours of the major work may take the form of a master's thesis. The candidate's committee will make all decisions as to the distribution of courses and the thesis requirement in the light of the student's aims and needs. The committee also will administer written and oral comprehensive examinations near the end of the candidate's course of study.

Special Summer Courses of Study Abroad—These courses are currently offered in Spanish and French, and German, and are listed in the WVU summer bulletin, but they usually begin early, before the end of May, and end around the first of July. Spanish courses are held at the University of Antioquia in the Republic of Colombia; French courses are conducted at Deauville in France; in Germany classes are held in Wilhelmshaven. Students normally sign up for two courses at West Virginia University, but all work is carried on overseas.

French

203. **Refresher Course in Conversational French.** I. 3 hr. PR: Consent. Intensive spoken French designed primarily for teachers of French in the elementary school.

205. **Fundamentals For Reading French.** I. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: Graduate status or upper-division status. The sequence 205-206 is intended for graduate students from other departments to teach them to read general and technical French.
206. **Reading French.** II. 3 hr. Undergraduate credit only. Graduate students must register as auditors. PR: 12 hr. of French or equiv. or French 205. Graduate students may meet the doctoral foreign language requirement by achieving a grade of B or better in this course. Not open to Foreign Language Department majors.
217. **French Civilization.** II. 3 hr. PR: 12 hr. of French.
221. **The Romantic Movement.** I. 3 hr. PR: A.B. in French or consent.
222. **French Realism.** II. 3 hr. PR: A.B. in French, or consent.
226. **Literary Criticism.** II. 3 hr. PR: A.B. in French or consent.
229. **Literature of the Sixteenth Century.** I. 3 hr. PR: A.B. in French or consent.
231. **Phonetics and Pronunciation.** II. 3 hr. PR: 18 hr. of French or equiv.
237. **Moliere.** II. 3 hr. PR: A.B. in French or consent.
244. **Explication de Textes.** II. 3 hr. PR: 18 hr. of French or equiv.
271. **The Modern Novel to 1930.** I. 3 hr. PR: A.B. in French or consent.
272. **The Novel After 1930.** II. 3 hr. PR: A.B. in French or consent.
281. **Medieval French Literature.** II. 3 hr. PR: Linguistics 290 (Old French) or consent.
292. **Pro-Seminar in French Literature.** 1-6 hr.* Special topics.
327. **Graduate Reading in French.** No Credit. A special course to help students prepare for the Ph.D. reading examination in French.
392. **Seminar in French Literature.** 1-6 hr.* Special topics.
497. **Research.** 1-15 hr.

Spanish

211. **Nineteenth Century Literature to 1870.** I. 3 hr. PR: Spanish 3 and 4, or equiv.
212. **Spanish Literature Since 1870.** II. 3 hr. PR: Spanish 3 and 4, or equiv.
216. **Spanish Civilization and Culture.** I. 3 hr. PR: 12 hr. of Spanish, or equiv.
217. **Spanish-American Literature and Culture.** I. 3 hr. PR: 12 hr. of Spanish, or equiv.
218. **Spanish-American Literature and Culture.** II. 3 hr. PR: 12 hr. of Spanish, or equiv. Continuation of Spanish 217.
221. **Literature of the Golden Age to 1635.** I. 3 hr. PR: 18 hr. of Spanish, or equiv.
222. **The Golden Age After Lope De Vega.** II. 3 hr. PR: 18 hr. of Spanish, or equiv.
223. **Estudios De Estilo.** I. 3 hr. PR: 18 hr. of Spanish, or equiv.

*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

- 224. **Explicacion De Textos.** II. 3 hr. PR: 18 hr. of Spanish, or equiv.
- 292. **Pro-Seminar in Spanish Literature.** 1-6 hr.* Special topics.
- 295. **Sixteenth Century Literature.** I. 3 hr. PR: 18 hr. of Spanish or consent.
- 297. **Pro-Seminar in Spanish-American Studies.** 1-6 hr.* Special topics.
- 315. **Lyric Poetry.** I. 3 hr. PR: 12 hr. of Spanish, or equiv.
- 325. **The Picaresque Novel.** I. 3 hr. PR: 18 hr. of Spanish, or equiv.
- 327. **Graduate Reading in Spanish.** No credit. A special course to help students prepare for the Ph.D. reading examination in Spanish.
- 391. **Cervantes.** II. 3 hr. PR: 18 hr. of Spanish or consent.
- 392. **Seminar in Spanish Literature.** 1-6 hr.* Special topics.
- 397. **Seminar in Spanish-American Studies.** 1-6 hr.* Special topics.
- 497. **Research.** 1-15 hr.

German

- 242. **Faust.** II. 3 hr. PR: German 4 or consent. Critical study of Goethe's Faust.
- 243. **Medieval German Literature.** I. 3 hr. PR: German 4 or consent.
- 244. **German Literature of the Reformation and Renaissance.** II. 3 hr. PR: German 4 or consent.
- 245. **Classicism and Romanticism.** I. 3 hr. PR: German 4 or consent. A critical study of German literature from 1750 to 1830.
- 246. **The Liberal Age.** II. 3 hr. PR: German 4 or consent. A critical study of German literature from 1830 to 1880, with an emphasis upon poetic realism.
- 247. **The Age of Crisis.** I. 3 hr. PR: German 4 or consent. A critical study of German literature from 1880 to the present.
- 265. **German Civilization.** I. 3 hr. PR: 12 hr. of German or consent. A general comprehensive survey of the most important aspects of German culture, including a brief historical background, the development of the German language, geography, science, music, art, architecture, literature, and philosophy.
- 292. **Pro-Seminar in German Literature.** 1-6 hr.* Special topics.
- 301. **Independent Reading.** I. 3 hr. Supervised reading for students who wish to do intensive work in any field of interest.
- 302. **Independent Reading.** II. 3 hr. Continuation of German 301.
- 327. **Graduate Reading in German.** No credit. A special course to help students prepare for the Ph.D. reading examination in German.
- 375. **The Modern Novel.** I. 3 hr. PR: 18 hr. of German. Supervised reading of nineteenth century novels.
- 376. **The Modern Novel.** II. 3 hr. Continuation of German 375, with emphasis on recent fiction.
- 392. **Seminar in German Literature.** 1-6 hr.* Special topics.
- 497. **Research.** 1-15 hr.

*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

Russian

211. **The Russian Novel. I.** 3 hr. PR: Russian 3 and 4 or consent. Study of selected work of Gogol, Goncharov, Turgenev, Leskov, Dostoevsky, and Tolstoy.
212. **The Russian Novel. II.** 3 hr. Continuation of Russian 211. Study of Russian prose from Chekhov to the post-war Soviet novelists.

Latin

201. **Roman Novelists. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin of the novel is traced from Homer to the Medieval Greek and Latin romance writers. Readings include selections from Petronius, the **Cena Trimalchionis**, and from Apuleius, **Cupid and Psyche**.
202. **Roman Comedy. II.** 3 hr. PR: Latin 109, 110, or equiv. A brief history of the origin and development of Greek and Roman comedy. Readings include the **Menaechmi** of Plautus, and the **Andria** of Terence.
231. **Roman Satire. I.** 3 hr. PR: Latin 109, 110, or equiv. Greek satirical writings and the origin of the Roman satire. Readings include selections from the **Satires** of Horace, and from the **Satires** of Persius and Juvenal.
234. **Roman Historians. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Roman historiography and its Greek antecedents. Readings include selections from Livy's **History**, from Tacitus' **Agricola**, and from Suetonius' **Augustus**.
235. **Roman Epic. I.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of the Greek and Roman epic. Readings include selections from Vergil's **Aeneid**, from Lucretius' **De Rerum Natura**, and from the earlier and later epic poets.
236. **Roman Philosophers. II.** 3 hr. PR: Latin 109, 110, or equiv. The origin and development of Greek philosophy and its influence upon Roman philosophy. Readings include selections from Cicero's **Tusculan Disputations** on the immortality of the soul and from Seneca's **Epistles**.
237. **Roman Lyric Poetry. I.** 3 hr. PR: Latin 109, 110, or equiv. Origin and development of the Greek and Roman lyric poetry. Readings include selections from Horace, Catullus, Tibullus, and Propertius.
292. **Pro-Seminar in Latin Literature.** 1-6 hr.* Special topics.
392. **Seminar in Latin Literature.** 1-6 hr.* Special topics.

Greek

292. **Pro-Seminar in Greek Literature.** 1-6 hr.* Special topics.
392. **Seminar in Greek Literature.** 1-6 hr.* Special topics.

Linguistics

201. **Linguistics As Applied to Spanish-American Dialects. I.** 3 hr. PR: A.B. in Spanish or consent. To acquaint students with the principles of structural linguistics and those points of structure and vocabulary in which American Spanish differs from standard Castilian.
225. **Comparative Grammar of Greek and Latin. I.** 3 hr. PR: Consent.
226. **Italic Dialects. II.** 3 hr. PR: Consent.

227. **Vulgar Latin. II.** 3 hr. PR: Latin 109, 110, or equiv. Selections from Latin inscriptions and later Latin literature are studied to illustrate the development of the Latin language from its earliest times to its passing into the Romance languages.
231. **The Structure of Modern Russian. I.** 3 hr. PR: 12 hr. of Russian or consent. Advanced study of Russian morphology and syntax.
232. **The Structure of Modern Russian. II.** 3 hr. PR: Linguistics 231 or consent. Advanced study of Russian morphology and syntax.
251. **History of the German Language. I.** 3 hr. PR: 18 hr. of German or consent. Historical development of standard German with emphasis on its relationship to the other Germanic languages and dialects.
255. **History of the Spanish Language. I.** 3 hr. PR: A.B. in Spanish or consent. A study of the development of the Spanish language and of the transformation of the Castilian dialect into the national language of Spain.
292. **Pro-Seminar in Linguistics.** 1-6 hr.* Special topics.
311. **Middle High German. I.** 3 hr. PR: 12 hr. of German from upper division. Study of the linguistic developments of Middle High German from the eleventh to the fifteenth centuries with illustrative reading from the *Nibelungenlied*.
312. **Middle High German. II.** 3 hr. Continuation of Linguistics 311 with illustrative readings from the Middle High German lyric poets and the courtly epics.
352. **Comparative Germanic Linguistics. II.** 3 hr. PR: Linguistics 351 or consent. A comparative study of Gothic, Old English, Old Norse, Old High German, and Old Saxon.
371. **Old English. I.** 3 hr. PR: Consent. Elementary study of Old West Saxon with illustrative materials from prose and poetry.
372. **Old English. II.** 3 hr. Continuation of Linguistics 271. Comparison of the Old English dialects, with extensive illustrative readings, especially in *Beowulf*.
381. **Old Norse. I.** 3 hr. PR: Consent. Elementary study of Old West Norse prose.
382. **Old Norse. II.** 3 hr. Continuation of Linguistics 381. Readings in various Old Icelandic sagas; introduction to Old Norse poetry.
390. **Old French. II.** 3 hr. PR: Consent.
392. **Seminar in Linguistics.** 1-6 hr.* Special topics.
396. **Old Spanish. II.** 3 hr. PR: Consent.

Language Teaching Methods

221. **The Teaching of Foreign Languages. I.** 3 hr. Required of all students who are prospective foreign language teachers on the secondary level.
222. **Language Laboratory Techniques. II.** 3 hr.
270. **Problems in the Teaching of French in the Elementary School. I.** 3 hr. PR: Consent.

*Variable credit courses normally carry 3 hr. credit. Exceptions are made only in emergencies and must be approved by the department chairman and the professor teaching the course.

421. **Teaching Foreign Languages in College and University.** I. 3 hr. A study of the theories and practices of contemporary foreign language teaching at the college level. Required of all graduate assistants in the Department of Foreign Languages.

Bibliography and Research

265. **Methods of Research.** I. 3 hr.

GEOLOGY AND GEOGRAPHY

The Department of Geology and Geography offers work leading to the degrees of Master of Arts, Master of Science, and Doctor of Philosophy in Geology. No graduate degree is offered in Geography.

The Degree of Master of Arts

This degree enables the holder of a baccalaureate degree to become well acquainted, although not professionally trained, in the earth and environmental sciences. The program is directed toward regional planners, teachers, businessmen, research administrators, and students interested in environmental aspects of earth sciences.

Acceptance by the Graduate School and also by the Department of Geology and Geography is necessary before admission of any prospective student to the program. One departmental requirement is previous college study of earth science or related subjects. This requirement may be fulfilled by an undergraduate major (or first teaching field) in biology, chemistry, physics, engineering, regional planning, earth science or geography.

The minimum work involves 36 hours and if thesis option is elected, the research hours may be included in this total. Up to 18 hours of cognate work at the graduate level (in biology, chemistry, physics, engineering, mathematics, education, geography, statistics, and closely related social sciences) may be included in the program.

The Degree of Master of Science

Before being admitted to candidacy for the Master of Science degree in Geology, the student must have completed the equivalent of the courses listed in the College of Arts and Sciences section of the *Undergraduate Catalog* as curricular requirements for undergraduates majoring in geology. Students who have not had a year of physics, a year of chemistry, and mathematics through Math. 15 (Calculus I), will be required to meet these requirements. They therefore will spend more than the minimum time for the Master of Science or Doctor of Philosophy degrees. Most employment requirements in technical fields, such as petroleum geology, now include not only advanced physics and chemistry but also mathematics through calculus. Employment opportunities are lim-

ited unless this requirement is met. Graduate students are expected to take some supporting courses in such allied fields as mining engineering, geophysics, and biology—depending on their major field of geologic studies.

A grade-point average of at least 3.0 (B) is required for an advanced degree in all courses in geology taken in the department while a graduate student. Scores in the general aptitude and geology tests of the Graduate Record Examination must be submitted. Each student must pass satisfactorily a comprehensive qualifying examination as an additional requirement before being admitted to candidacy for an advanced degree.

A thesis is required of all candidates for the Master of Science degree in geology. The thesis may be based on field work done while not in residence at the University by arrangement with the candidate's advisory committee. Final examinations on general geologic knowledge and thesis subject must be passed by each candidate for an advanced degree.

Prospective students are urged to write the Chairman of the Department of Geology and Geography before making application to the Dean of Admissions and Records of the University for admission to the Graduate School.

The Degree of Doctor of Philosophy

In addition to the requirements above, the general requirements for the doctor's degree are set forth in Part II of this bulletin.

Opportunities for Research

Close cooperation between the West Virginia Geological and Economic Survey, located in Morgantown, and the Department of Geology makes a large amount of material available for laboratory investigation. This includes the fossil collections of the Department and the Survey. A large number of samples of drill cuttings from deep wells in West Virginia and adjoining states are housed in the Survey. Morgantown is conveniently situated for detailed studies of Mississippian, Pennsylvanian, and Permian formations. Mineral products of the region near Morgantown include coal, petroleum, natural gas, and limestone. The occurrence and utilization of these materials can be studied by graduate students interested in economic geology. A permanent summer field camp (Camp Wood) is located in the Folded Appalachians at Alvon, Greenbrier County, West Virginia.

Geology

Geol.

201. **Physical Geology for Teachers.** I, II, S. 3 hr. PR: High School teaching certificate, and consent. Composition and structure of earth and the geologic processes which shape its surface.

202. **Physical Geology Laboratory for Teachers.** I, II, S. 1 hr. Accompanies Geol. 201. Laboratory and field study of earth materials and features, and the topographic and geologic maps used to represent them.
218. **Geology and the Earth Sciences.** 4 hr. PR: Open only to members of N.S.F. Summer Institute. The physical nature of the earth. Rotation, revolution, shape, and structure of the earth. Geologic forces changing the earth. Geologic history.
221. **Geomorphology.** I. 3 hr. Surface features of eastern United States.
222. **Geomorphology.** II. 3 hr. Surface features of western United States. (Offered in alternate years).
228. **Photogeology.** II. 3 hr. PR: Geol. 127, 151. Instruction in basic and advanced techniques of air photo interpretation.
231. **Invertebrate Paleontology.** I, II. 4 hr. PR: Geol. 3, 4. Invertebrate fossils; biologic classification, evolutionary development, and use in correlation of strata.
235. **Introductory Paleobotany.** I, II. 4 hr. PR: Geol. 3 and/or Bot. 2. Resume of development of principal plant groups through the ages, present distribution, mode of occurrence and index species, methods of collection.
261. **Stratigraphy and Sedimentation.** II. 3 hr. Study of sediments and sedimentary rocks. Field techniques stressed as data gathered and interpreted from rocks of Pennsylvanian age in Morgantown vicinity. Two-day field trip required.
266. **Appalachian Geology Field Camp.** S. 6 hr. PR: Geol. 231, 261. Practical experience in detailed geological field procedures and mapping. Living expenses in addition to tuition must be paid at time of registration.
270. **Mineral Resources.** I. 3 hr. PR: Geol. 1, 184. Description, mode of occurrence, and principles governing the formation of ore deposits.
272. **Petroleum Geology.** II. 1-4 hr. PR: Geol. 151. Origin, geologic distribution, methods of exploration and exploitation, uses and future reserves of petroleum and natural gas in the world.
290. **Geologic Problems.** I, II. 1-6 hr. (Max. 12 hr.). Special problems for seniors and graduates.
291. **Seminar.** I. 1 hr.
329. **Problems in Geomorphology.** I, II. 1-4 hr.
334. **Problems in Paleontology.** I, II. 1-4 hr.
336. **Advanced Paleobotany.** I, II. 4 hr. Continuation of Geol. 235.
339. **Problems in Paleobotany.** I, II. 1-4 hr.
340. **Advanced Stratigraphy.** II. 4 hr. PR: Geol. 231. Study of principles of rock and time correlation, emphasis on their application to the stratigraphy of West Virginia.
344. **Clay Geology.** I, II. 2-3 hr. PR: Geol. 185, 261, 369. Study of clay mineralogy with secondary emphasis on the origin and deposition of clay minerals in the stratigraphic record.
346. **Advanced Sedimentation.** I. 4 hr. PR: Geol. 185. Origin of sedimentary rocks; principles involved in interpretation of ancient geography, climates, animals, and plants.

348. **Problems in Sedimentation.** I, II. 1-4 hr.
349. **Problems in Stratigraphy.** I, II. 1-4 hr.
351. **Tectonic Elements.** II. 3 hr. PR: Geol. 151. Detailed analyses of tectonic elements of North America and Europe.
359. **Problems in Structural Geology.** I, II. 1-4 hr.
362. **Sedimentology Field Camp.** S. 3-6 hr. PR: Geol. 261 or equiv. Field-lab course in experimental, modern, and ancient sedimentation. Living expenses in addition to tuition must be paid at time of registration.
363. **Ground-water Hydrology.** II. 3 hr. PR: Geol. 1 or consent. Study of the principles of ground-water hydrology; occurrence, development, uses, and conservation of ground-water.
369. **X-Ray Diffraction.** I, II. 3 hr. Open to advanced students in geology, chemistry, engineering, and related fields, with consent of instructor. The theory of X-ray diffraction and application to the analysis of crystalline materials using the powder camera and X-ray diffractometer.
371. **Economic Geology: Ore Deposits.** II. 3 hr. PR: Geol. 185. Mineral composition, geologic features, and distribution of deposits of principal useful metallic minerals.
372. **Economic Geology: Nonmetallics.** I. 3 hr. PR: Geol. 185. Occurrence, formation, and use of nonmetallic mineral substances, including materials and chemicals.
374. **Problems in Economic Geology and Geochemistry.** I, II. 1-4 hr.
385. **Optical Mineralogy.** I. 4 hr. PR: Geol. 185 and one year of Physics. Principles and practice in use of the petrographic microscope in identification of minerals. Emphasis on determination by immersion method.
386. **Petrology.** II. 4 hr. PR: Geol. 285. Composition, texture, occurrence, and origin of rocks. Study of hand specimens and thin sections.
388. **Problems in Mineralogy and Petrology.** I, II. 1-4 hr.
394. **Introductory Geochemistry.** I. 3 hr. PR: Geol. 185 or consent. Evolution of earth as suggested by chemical and physical data, followed by topics of current interest, including geologic thermometry, oxidation potential and pH, and geochemical prospecting.
395. **Geochemistry.** II. 3 hr. PR: Geol. 185 or consent. Mineral systems at low temperatures and low pressures considered in terms of partial pressure, oxidation potential and pH. Laboratory study includes directed investigation of a topic of interest to the student.
399. **Quantitative Methods in Geo-Sciences.** II. 4 hr. PR: Stat. 101, 201 and 202 or 311 and 312, and consent. A brief review and introduction to specific quantitative techniques, as applied to geology and geography.
432. **Micropaleontology.** I. 4 hr. PR: Geol. 231. Identification of Foraminifera and Ostracoda; emphasis on classification, nomenclature, and use of paleontological literature.
487. **Advanced Petrology.** I. 3 hr. PR: Geol. 386. Study of the composition, classification, and origin of igneous and metamorphic rocks. Laboratory work consists of a study of crystalline rocks by microscopical methods.
497. **Research.** I, II. 1-15 hr.

Geography

Geogr.

- 202. **Political Geography.** I. 3 hr. PR: Consent. Examination of spatial inter-relationships of man and his environment in a political setting.
- 203. **Historical Geography of Anglo-America.** II. 3 hr. Exploration, settlement, and changing patterns of human occupancy from the sixteenth century to the present; cultural areas and their significance.
- 210. **Urban Geography.** II. 3 hr. Location, development, and change of urban land use patterns.
- 219. **Problems in Geography.** I, II. 3 hr. per sem.; max. credit 12 hr. PR: Consent.
- 220. **Seminar in Geography.** I, II. 3 hr. per sem.; max. credit 12 hr.
- 240. **Geography of the USSR and Eastern Europe.** II. 3 hr. Regional characteristics and problems of development.
- 246. **Geography of Africa.** II. 3 hr. Systematic and regional characteristics and geographic problems of political, social, and economic development.
- 261. **Cartography.** I. 3 hr. Theory and practice of map design.

HISTORY

The Degree of Master of Arts

Candidates for admission to the master's degree program in history should have had 18 hours of upper-division undergraduate work in history and 9 hours of upper-division undergraduate work in some closely related subject, preferably economics, political science, or sociology. A reading knowledge of one foreign language is desirable. Candidates should have a minimum 2.5 overall average in the undergraduate program and a minimum 3.0 overall average in their majors or minors in history.

The Department of History requires that all candidates for the Master of Arts degree in history present an overall average of 3.0 (B) for all graduate courses taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than "B."

There are two routes to the Master of Arts Degree in history: a 36-hour degree and a 30-hour degree. The 36-hour degree includes a minimum of 24 semester hours in history, six of which shall consist of courses of the 400 seminar series. It is possible to include in the 36-hour program a minimum of 9 to 12 hours in one minor representing a closely related discipline in the College of Arts and Sciences. It is also possible that all 36 hours be in the Department of History. The candidate for the 36-hour masters will be required to pass a final oral comprehensive examination covering his graduate course work.

The 30-hour degree consists of 24 hours of course work in history and incorporates a thesis for which 6 hours credit may

be allowed. The candidate for the 30-hour masters will be required to pass a final oral comprehensive examination covering his graduate course work and his thesis.

The Degree of Doctor of Philosophy

Requirements for the Ph.D degree in history include the general requirements of the Graduate School; a reading knowledge of a second foreign language approved by the Department; passing the Ph.D. comprehensive examination of two parts (oral and written) administered by a committee of faculty members (normally at the end of a full-time student's second year of study); preparation of an acceptable dissertation based upon original investigation; and successful defense of the dissertation in a final examination.

A candidate must offer a program of study in four fields, at least three of which must be in history; the other may be in a related field approved by the Department. The Department of History requires that all candidates for the doctor's degree present an overall average of 3.0 (B) for all graduate courses taken; it will not accept toward an advanced degree credits in courses offered by the Department of History which are reported with a grade lower than "B." The fields must be selected from the following:

- | | |
|-----------------------------------|---------------------------------|
| 1. History of the U.S. to 1865 | 6. Europe, 1789-present |
| 2. History of the U.S. Since 1850 | 7. History of England |
| 3. Medieval History | 8. History of Asia and Africa |
| 4. Renaissance and Reformation | 9. Latin America |
| 5. Europe, 1500-1815 | 10. Field in another department |

History

Hist.

- 201. **British Civilization to 1660.** 3 hr.
- 202. **British Civilization Since 1660.** 3 hr.
- 205. **Latin American History, Colonial Period and the Wars of Independence.** 3 hr.
- 206. **Latin America Since 1824.** 3 hr.
- 209. **The ABC Powers of Latin America.** 3 hr.
- 210. **Modern Spain.** 3 hr.
- 213. **The Old Regime in Europe.** 3 hr.
- 214. **The Revolutionary-Napoleonic Era.** 3 hr.
- 215. **Diplomatic History of the U.S.S.R., 1917 to 1939.** 3 hr.
- 216. **Diplomatic History of the U.S.S.R., 1939 to Present.** 3 hr.
- 217. **History of Russia From Ancient Times to Alexander III.** 3 hr.
- 218. **History of Russia: The Revolutionary Era and the Soviet Period.** 3 hr.
- 221. **History of Germany From the Roman Era to the Early Nineteenth Century.** 3 hr.

222. **History of Modern Germany.** 3 hr.
225. **History of Modern China.** 3 hr.
226. **History of Modern Japan.** 3 hr.
229. **History of Africa: Pre-Colonial.** 3 hr.
230. **History of Africa: European Dominance to Independence.** 3 hr.
251. **History of Black People in America to 1900.** 3 hr.
252. **History of Black People in America Since 1900.** 3 hr.
253. **Civil War and Reconstruction.** 3 hr.
255. **The Cleveland Era.** 3 hr.
257. **The U.S. From McKinley to the New Deal, 1896 to 1933.** 3 hr.
259. **Recent American History, 1933 to Present.** 3 hr.
261. **Economic and Social Development of West Virginia.** 3 hr.
301. **Social and Economic History of the Middle Ages, 300-1000.** 3 hr.
302. **Social and Economic History of the Middle Ages, 1000-1500.** 3 hr.
305. **The Renaissance.** 3 hr.
306. **The Reformation.** 3 hr.
309. **English Social History, Fourteenth to Eighteenth Century.** 3 hr.
310. **English Social History, Eighteenth Century to the Present.** 3 hr.
313. **European Diplomatic History, 1815 to 1919.** 3 hr.
314. **European Diplomatic History, 1919 to the Present.** 3 hr.
- 317, 318. **European Cultural and Intellectual History.** 3 hr. each.
351. **American Diplomacy to 1918.** 3 hr.
352. **American Foreign Policy and Diplomacy, 1918 to the Present.** 3 hr.
355. **Intellectual and Social History of the U.S. to 1876.** 3 hr.
356. **Intellectual and Social History of U.S. Since 1876.** 3 hr.
359. **American Economic History to 1865.** 3 hr.
360. **American Economic History Since 1865.** 3 hr.
363. **American Labor Movement.** 3 hr.
364. **History of American Agriculture.** 3 hr.
367. **The Old South.** 3 hr.
368. **The New South.** 3 hr.
371. **American Frontier East of the Mississippi.** 3 hr.
372. **American Frontier West of the Mississippi.** 3 hr.
- 401, 402. **Readings, Seminar in Medieval History.** 3 hr. each.
- 405, 406. **Readings, Seminar in English History.** 3 hr. each.
- 409, 410. **Readings, Seminar in Central European History.** 3 hr. each.
- 413, 414. **Readings, Seminar in Eastern European History.** 3 hr. each.
- 417, 418. **Readings, Seminar in Western European History.** 3 hr. each.
- 421, 422. **Readings, Seminar in Asian History.** 3 hr. each.
- 425, 426. **Readings, Seminar in African History.** 3 hr. each.

- 451, 452. Readings, Seminar in American History, 1492-1789. 3 hr. each.
- 455, 456. Readings, Seminar in American History, 1763-1865. 3 hr. each.
- 459, 460. Readings, Seminar in American History, 1850-1898. 3 hr. each.
- 463, 464. Readings, Seminar in American History, 1890 to Present. 3 hr. each.
- 467, 468. Readings, Seminar in Frontier History. 3 hr. each.
- 473, 474. Readings, Seminar in Local and Regional History. 3 hr. each.
- 477. American Historiography. 3 hr.
- 478. European Historiography. 3 hr.
- 481, 482. Special Problems. 1-3 hr. each.
- 497. Research. 1-15 hr.

THE HUMANITIES

The following courses are offered during the Summer only according to demand. They are primarily intended for students of art, humanities, literature, and related fields.

Humanities

- 250. **Culture Tour of Europe.** S. 6 hr. PR: Some cultural background in European civilization such as Humanities 1 and 2, Hist. 1 and 2, art survey courses, or equiv., or consent.
- 260. **Culture Tour of Latin America.** S. 6 hr. PR: Some cultural or historical background in Latin America, such as history or art courses, or consent.
- 270. **Cradle of History Tour of the Near East.** S. 6 hr. PR: Humanities 1 and 2, Hist. 1 and 2, or equiv., or consent.
- 280. **Around-the-World Culture Tour.** S. 6 hr. PR: A course in world or western civilization, such as Humanities 1 and 2, Hist. 1 and 2, or consent.

LIBRARY SCIENCE

Admission Requirements: Students wishing to do graduate work in Library Science must satisfy the general requirements for admission to the Graduate School.

The Department of Library Science offers a graduate program which culminates in a Master of Arts degree in Education with a field in Library Science. This degree is granted in conjunction with the College of Human Resources and Education and the Graduate School.

The courses are designed for:

1. Elementary or secondary school teachers who wish to meet the certification requirements for school librarians in West Virginia and other states.
2. School librarians who plan to develop professionally.
3. Teachers and school librarians in need of in-service training.
4. Administrators who wish to broaden their knowledge and training in the field of school library media.

The student will be admitted to the graduate program when he has met the following departmental requirements:

1. A Bachelor's degree from an approved college or university with the evidence of 3 semester hours credit in Lib. Sci. 201 (Basic Reference) or equivalent.

2. A broad cultural background, with a field of specialization, and Teacher Certification in Elementary or Secondary Education.

3. Evidence of ability to undertake the completion of the Library Science program as well as promise of professional proficiency as shown by previous academic record.

4. A personal interview whenever possible.

Degree Requirements: The candidate for the Master of Arts in Education degree with a field in Library Science will be required to complete 30 semester hours of graduate study consisting of:

(1) a. Eighteen graduate hours in Library Science, with an average of B, of which at least 3 hours will be in courses of "400" series; or

b. Twelve graduate hours in Library Science with an average of B, of which at least 3 hours will be courses of "400" series, and 6 graduate hours in a related field (with faculty adviser approval) with an average of B.

(2) a. Nine hours graduate courses in Education with an average of B, Audio-Visual Resources and Introduction to Education Research, and 3-6 hours of electives.

b. A 3-hour problem report (Lib. Sci. 411 or C & I 319) in same phase of Librarianship; thus completing the 30 semester hours necessary for the degree.

c. A written comprehensive examination.

Required Courses in Education..... 9 hr.

Ed. Psych. 260—Audio-Visual Resources in Education..... 3

Ed. Psych. 320—Introduction to Education Research..... 3

C & I 391—Problem in Education (Library Science)..... 3

Electives from this group 3-6 hr.

Ed. Psych. 330—Educational Measurements 3

Ed. Psych. 362—Organizing Programs of

Audio-Visual Instruction 2

Ed. Found. 320—Philosophy of Education..... 3

C & I 301—Elementary School Curriculum..... 3

C & I 304—Secondary School Curriculum..... 3

Ed. Adm. 300—Public-school Organization and

Administration..... 3

Ed. Psych. 440—Human Development and Behavior..... 3

Ed. Found. 340—History of Education..... 3

C&G 303—Basic Course in Guidance..... 3

Library Science

Lib. Sci.

201. **Reference and Bibliography.** I, II, S. 3 hr. PR: Consent. Basic reference books, dictionaries, encyclopedias, indexes, yearbooks, and other reference materials are studied and evaluated, with emphasis on the theory

of and practical experience with reference books. Required for Library Science majors.

203. **Library Materials for Children.** I, II, S. 3 hr. A survey of children's literature in the light of historical development, with emphasis on current trends. Consideration of the criteria for and means of evaluating print and nonprint materials for support of the curriculum, recreation and child guidance.
205. **Selection of Books and Related Materials for the Secondary School Library.** I, S. 3 hr. A survey of adolescent literature and other library materials adapted to the needs of junior and high school students.
207. **Organization and Administration of the Instructional Materials Center in the Secondary School.** I, S. 3 hr. PR: Lib. Sci. 205, 223, for school librarians. A study of organization and administration, including planning, equipment, routines, and schedules, and the role of the librarian in the instructional program.
222. **Field Practice.** I, II, S. 3 hr. PR: Lib. Sci. 201, 203, 205, 207 or 235, 223. Practical experience in a variety of public, school, and special libraries under the supervision of experienced librarians. Students must complete 100 clock hours.
223. **Cataloging and Classification.** I, II, S. 3 hr. Basic principles and problems of cataloging and classification combined with practical experience in processing the various types of books and materials. Problems peculiar to the teacher-librarian will be considered.
224. **History of Books and Libraries.** I, S. 3 hr. A survey course, including the development of the book from early manuscript form, history of printing, printers, book illustration, bindings, and the library and its development.
235. **Organization and Administration of the Instructional Materials Center in the Elementary School.** II, S. 3 hr. PR: Lib. Sci. 223 for school librarians. Includes planning quarters; selection, acquisition and organization of books and other materials; supervision of library assistants; and relations with faculty, administration, and community.
321. **Public and Regional Library Service.** S. 3 hr. PR: Consent. Principles governing the administration of tax-supported public libraries and the development of larger units of service.
325. **Books and Reading for Adults.** II, S. 3 hr. Reading and evaluation of representative books in broad subject fields.
326. **Literature of the Social Sciences.** I, S. 3 hr. PR: Consent. Bibliographic and reference sources in the social sciences. The course is designed to give the student a good working knowledge of the major sources of information in the social sciences and the ability to make effective use of the library.
327. **Literature of the Humanities.** I, S. 3 hr. Bibliographic and other reference sources in the major subject areas of the humanities, including religion, philosophy, fine arts, music, and literature.
328. **Literature of Science and Technology.** II, S. 3 hr. PR: Consent. A course designed to give the student a good working knowledge of the increasingly complex literature of science and technology.
330. **Library Resources for the School Curriculum.** II, S. 3 hr. Broadened experiences in both library and outside resources that lend themselves to curriculum enrichment, including guidance, remedial reading, text-

books, community resources, all phases of audio-visuals, etc. Presented to elementary and secondary teachers, as well as librarians, to help them give more effective services.

404. **Advanced Cataloging and Classification.** II, S. 3 hr. PR: Lib. Sci. 223.

MATHEMATICS

The Department of Mathematics offers the Master of Arts and the Master of Science degrees. The Master of Arts degree is considered to be the predoctoral degree in mathematics and is considered to be preliminary training in mathematics for college teaching. The Master of Science degree offers more flexibility for those students who expect to enter the high school teaching field or who plan to become research assistants in industry, research laboratories, statistics centers, computing centers, the actuarial field, and other areas requiring specialized training in mathematics.

Upon application for admission to Graduate School for the study of mathematics the student should make available to this department his score on the Graduate Record Examination in Advanced Mathematics. If the student has not taken this examination he must do so at its first offering during his first semester of study. It is the responsibility of the student to acquaint himself with the requirements of the Graduate School, particularly with respect to deadlines for applying for degree-completing examinations, etc.

Students who expect to do graduate work in mathematics must have completed the equivalent of the mathematics requirements for an undergraduate major at West Virginia University. By permission, deficiencies in preparation may be made up after admission to the department by the completion of recommended undergraduate courses. It may be possible for a student to remove deficiencies by taking a comprehensive qualifying examination, the purpose of which is to determine his undergraduate background and to check on his fitness to pursue graduate work in the department. If deficiencies are to be cleared by test, this must be done either prior to his first registration or early in the first semester (or term) in which he enrolls.

Students are expected to maintain at least a 3.0 (B) average in their mathematics courses and to present at least a 3.0 (B) average in all course work offered in fulfillment of the degree requirements.

Departmental Requirements and Policy

Candidates for the Master of Arts degree (prerequisite for doctoral work in mathematics) must complete a minimum of 30 hours credit, of which at least 24 must be in the "300" series of mathematics. At least six hours must be completed in each of three of the following fields: Algebra, Analysis, and Topology.

The student should demonstrate proficiency in one foreign language prior to the final semester in which the degree requirements are met. This is done by arranging for the examination with the Foreign Language Examiner. Languages acceptable are: French, German, Russian, Italian. Others may be accepted, if special research and study require a knowledge of them (for example, Greek, Latin, Arabic, Polish, Hungarian, etc.).

A 3.0 (B) average is prerequisite to the writing of the comprehensive examinations in the areas of study, or the taking of the final oral examination.

The M.A. degree requires a special in-depth study designed to measure and enhance the student's mathematical maturity and his depth of achievement. The student should check with the Department Chairman or the Chairman of the Departmental Graduate Advisory Committee for thesis options and time schedules for completion.

Candidates for the Master of Science degree must complete a minimum of 30 hours of credit. The program will be worked out in conference with the Graduate Adviser's Committee, and will usually include at least 24 hours of courses selected from the "300" series in mathematics. Students should check with the Chairman of the Department or the Chairman of the Departmental Graduate Advisory Committee prior to planning the preservice experience recommended for the M.S. degree. No course work required for the removal of deficiencies may be included in the thirty hours offered for the degree.

Students who wish to do a minor part of their work in an applied area (for example, Physics, Engineering), or related areas in Education, should confer with the Graduate Adviser for prior approval of their Master's program. Cooperation with these departments and divisions is encouraged when the student will be served by this arrangement. The Department of Mathematics approves and promotes cooperation with other divisions of the University in developing graduate programs.

The department serves many related fields in that it supplies background work for the areas of numerical analysis, computer science, analysis, applied mathematics, probability, statistics, and a variety of engineering and mathematics education programs.

Mathematics

Math.

- 214. **Vector Analysis.** I, II. 3 hr. PR: Math. 18. Primarily for engineers and scientists. Vector algebra, differential operators, curvilinear coordinate systems, Stokes' and Gauss' theorems, applications, linear systems of equations, matrices, determinants, quadratic forms, eigenvalues and canonical forms, and numerical inversions.
- 215. **Applied Modern Algebra.** 3 hr. Introduction to graph theory, boolean algebras, monoids, finitestate and Turing machines with applications to optimization of computer design, algebraic coding theory and computer languages, especially ALGOL. For advanced undergraduates and

beginning graduate students in mathematics, computer science, and technology.

219. **Seminar in Applied Mathematics.** I, II. 1-12 hr.
226. **Mathematical Statistics.** II. 3 hr. PR: Math. 51. Discrete and continuous variables; correlation, regression, sampling theory; normal, chi-square, t, and F distributions; significance tests; analysis of variance.
- 231, 232. **Introduction to Mathematics for the Elementary Teacher.** I, II. 3 hr. per sem. PR: Math. 33, 34 or consent. Systems of numeration; sets, relations, binary operations, decimal and other base systems; natural numbers, integers, rational numbers, and real numbers with emphasis on the algebraic structure of each; the notions of length, area, and volume; pythagorean theorem; and coordinate geometry. Not open to students with credit for Math. 131, 132. This course is designed especially for inservice elementary mathematics teachers. Other students may be admitted with departmental approval obtained prior to registration.
239. **Elementary Number Theory.** II. 3 hr. PR: Math. 16 or Math. 131 or consent. A study of divisibility, congruences, linear and quadratic diophantine equations, number theoretic functions, and applications of number theory to other areas of mathematics.
241. **Introduction to Linear Algebra.** I, II. 3 hr. PR: Math. 163 or consent. A study of vector spaces, matrices, determinants, linear transformations, bilinear and quadratic forms, related topics.
- 251, 252. **Introduction to Real Analysis.** I, II. 3 hr. PR: Math. 163 or consent. A study of sequences, limits, continuity, definite integral, convergence, differentiation, differentials, functional dependence, multiple integrals, line and surface integrals, and differential forms.
255. **Advanced Real Calculus.** S. 3 hr. PR: Math. 51. Limits, series, metric spaces, uniformity, integrals.
256. **Complex Variables.** II. 3 hr. PR: Math. 18 or 51. Complex numbers, functions of a complex variable; analytic functions; the logarithm and related functions; power series; Laurent series and residues; conformal mapping and applications.
261. **Mathematical Logic 2.** I or II. 3 hr. PR: Math. 161. Formalization of the material in the previous term, the concepts of consistency, decidability, and completeness (equivalent to Philosophy 206).
263. **Proseminar.** 3 hr. An introduction to the foundations of mathematics via axiomatic set theory and cardinal and ordinal numbers, with emphasis on application to other parts of mathematics.
265. **Introduction to Metamathematics I.** I. 3 hr. PR: Consent. Survey of the methodology of the deductive sciences with emphasis on the theory of proof and effective operations therein.
266. **Introduction to Metamathematics II.** II. 3 hr. PR: Math. 265. This course deals with recursive function theory. Godel's proof and associated results.
269. **Advanced Topics in Mathematics.** 3-9 hr. PR: Consent. An independent but directed study program, the content of which is to be mutually agreed upon by the individual student and the instructor.
271. **Projective Geometry.** II. 3 hr. PR: Math. 141, 241 or consent. Projective and affine spaces, transformation groups for planes. Introduction to axiomatic plane geometrics.
290. **Advanced Topics in Mathematics.** I, II, S. 3-9 hr. An independent, but directed study program the content of which to be mutually agreed upon by the individual student and instructor.

- 291, 292. **Theory of Probability.** I, II. 3 hr. per sem. PR: Math. 51. Fundamental theorems. Development of density and distribution functions in the discrete and continuous cases. Classical problems and solutions. Moments, characteristics functions, limit theorems. Applications.
- 301, 302. **Combinatorial Analysis.** I, II. 3 hr. per sem. PR: One year of calculus. Permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, compositions, trees, and networks.
- 305, 306. **Theory of Numbers.** I, II. 3 hr. PR: One year of calculus. Introduction to classical number theory, covering such topics as divisibility, the Euclidean algorithm, Diophantine equations, congruences, primitive roots, quadratic residues, number-theoretic functions, distribution of primes, irrationals, and combinatorial methods. Special numbers, such as those of Bernoulli, Euler, and Stirling.
312. **Partial Differential Equations.** I. 3 hr. PR: Math. 113. Primarily for engineers and scientists. One-dimensional wave equations, linear second-order equations in two variables, elliptic and parabolic equations, Fourier series, non-homogeneous and higher dimension problems, Sturm-Liouville theory, and approximate methods.
313. **Intermediate Differential Equations.** II. 3 hr. PR: Math. 113, 252 (or 318). Second-order linear equations, Riccati equation, complex variables. Series solutions. Equations of Fuchsian type, hypergeometric equation, confluence of singularities. Classical equations, applications.
314. **Tensor Analysis.** II. 3 hr. PR: Math. 214, 252, (or 318). Vector concept developed from standpoint of algebraic invariants, surface geometry, tensor operators, curvature tensor. Ricci and Bianchi identities, applications of tensors to physical phenomena.
315. **Operational Methods in Partial Differential Equations.** II. 3 hr. PR: Math. 113, 252, (or 318). Laplace transformation, properties and elementary applications; problems in partial differential equations; complex variable; problems in heat conduction, mechanical vibration, etc. Sturm-Liouville systems. Fourier transforms.
- 317, 318. **Advanced Calculus.** I, II. 3 hr. per sem. PR: Math. 18. Primarily for engineers and scientists. Functions of several variables, partial differentiation, implicit functions, transformations; line, surface and volume integrals; point set theory, continuity, integration, infinite series and convergence, power series, and improper integrals.
319. **Seminar in Applied Mathematics.** 1-12 hr.
- 321, 322. **Introduction to Numerical Analysis.** I, II. 3 hr. per sem. PR: Math. 51 and Math. 241 or Math. 214 or consent. Approximation of functions, iteration procedures, numerical integration and differentiation, numerical solution of linear and nonlinear equations, and ordinary differential equations, error analysis and pitfalls of computation.
- 333, 334. **Foundations of Algebra.** S. 2 hr. per sem. PR: Differential and integral calculus, or consent. Not open to students with credit for Math. 236. Introduction to algebraic structures: rings, the integral domain of integers, properties of the integers, fields, polynomials over a field, groups; matrices; linear systems; vector spaces; vector geometry; linear transformations; and linear programming. This course is designed especially for prospective high school mathematics teachers. Other students may be admitted with departmental approval obtained prior to registration.
- 335, 336. **Foundations of Geometry.** S. 2 hr. PR: Differential and integral calculus, or consent. A study of affine, projective, Euclidean, and non-

- Euclidean geometries. This course is designed especially for prospective high school mathematics teachers. Other students may be admitted with departmental approval obtained prior to registration.
- 337, 338. **Probability and Statistics.** S. 2 hr. per sem. PR: Differential and integral calculus or consent. Finite sample space, measure of the set of outcomes and probability of events, independent trials, functions on the sample space, approximations to the binomial distribution, elementary statistical inference, continuous sample space, limit theorems, stochastic processes, statistical models, and applications. This course is designed especially for prospective high school mathematics teachers. Other students may be admitted with departmental approval obtained prior to registration.
339. **Special Topics.** I, II, S. 1-12 hr.
- 341, 342. **Modern Algebra.** I, II. 3 hr. per sem. PR: Math. 141, or consent. Concepts from set theory and the equivalence of the Axiom of Choice. Zorn's Lemma and the Well-Ordering Theorem; a study of the structure of groups, rings, fields, and vector spaces; elementary factorization theory; extensions of ring and fields; modules and ideals; and lattices.
343. **Linear Algebra.** II. 3 hr. PR: Math. 241 or consent. Review of theory of groups and fields; linear vector spaces including the theory of duality; full linear group; bilinear and quadratic forms; and theory of isotropic and totally isotropic spaces.
349. **Automata Theory.** 3 hr. The mathematical aspects of information processing, including devices, languages and structure of general systems.
- 351, 352. **Theory of Functions of Real Variables.** I, II. 3 hr. per sem. PR: Math. 141, 181, 252. Measure. Integration. Topics from functional analysis.
- 355, 356. **Theory of Functions of Complex Variables.** I, II. 3 hr. per sem. PR: Math. 252. Number systems, the complex plane and its geometry, fractions, powers, roots and transformations, Holomorphic functions, power series, elementary functions, complex integration, representation theorems, the calculus of residues, analytic continuation and analytic function, Elliptic functions, Holomorphic functions of several complex variables.
357. **Calculus of Variations.** II. 3 hr. PR: Math. 113, 252, (or 318). Maximum and minimum value of an integral, shortest distance, the brachistochrone problem, surface of revolution of minimum area, conditions for a relative minimum. Applications.
- 375, 376. **Differential Geometry.** I, II. 3 hr. per sem. PR: Math. 141, 271. Elementary differential geometry. Transformation groups. Space curves. Geometry of surfaces.
- 381, 382. **Topology.** I, II. 3 hr. per sem. PR: Math. 252 or consent. A detailed treatment of topological spaces covering the topics of continuity, convergence, compactness, and connectivity; product and identification spaces, function spaces, and the topology in Euclidean spaces.
- 383, 384. **Algebraic Topology.** I, II. 3 hr. per sem. PR: Math. 381, 341 (or consent). Singular homology and cohomology theories; homotopy theory and generalized homology theories.
400. **Seminar in Number Theory.** I, II. 1-12 hr.
- 401, 402. **Special Functions.** I, II. 3 hr. PR: Math. 113, 252. Operational techniques; generalized hypergeometric functions; classical polynomials of Bell, Hermite, Legendre, Noerlund, etc. Introduction to recent Polynomial systems. Current research topics.

- 405, 406. **Analytic Number Theory.** I, II. 3 hr. per sem. PR: Math. 305-306, 141, 356. Selected topics in analytic number theory such as the prime number theorem; primes in an arithmetical progression; the Zeta function; the Goldbach conjecture.
409. **Seminar in Special Functions.** I, II. 1-12 hr.
- 435, 436. **Algebraic Plane Curves.** I, II. 3 hr. per sem. PR: Math. 271. General theory of curves, singularities, associated curves.
440. **Seminar in Algebra.** I, II. 1-12 hr.
- 441, 442. **Group Theory.** I, II. 3 hr. per sem. PR: Math. 141 or consent. Elementary group theory; Sylow theory, extended Sylow theory in solvable groups, Burnside's theorem on normal complements, transfer homomorphism. Representation theory. Emphasis throughout on finite groups.
- 443, 444. **Algebraic Theory of Semigroups.** I, II. 3 hr. per sem. PR: Math. 341-342, or equivalent. Ideal theory, matrix representation of semigroups, decompositions and extensions, simple semigroups, inverse semigroups, congruence relations, recent research.
450. **Seminar in Analysis.** I, II. 1-12 hr.
- 451, 452. **Functional Analysis.** I, II. 3 hr. per sem. PR: Math. 252 or consent. Linear spaces, seminorms, norms, metrics, Banach spaces, Hilbert spaces, uniform boundedness theorem, the open mapping theorem, the closed graph theorem, Riesz's representation theorem, linear topological spaces, Hahn-Banach Theorem, convergence, convexity, duality, Banach algebras.
- 457, 458. **Theory of Partial Differential Equations.** I, II. 3 hr. per sem. PR: Math. 252, or equivalent. Elementary concepts; Cauchy problems; the Cauchy-Kowalewski theorem; general existence theorems; associated surfaces; classification into elliptic, parabolic, and hyperbolic types; conditions required of coefficients for solvability; techniques for solution; distribution theory; and numerical methods.
460. **Thesis.** I, II. 1-6 hr.
470. **Seminar in Geometry.** I, II. 1-12 hr.
- 471, 472. **Algebraic Geometry.** I, II. 3 hr. per sem. PR: Math. 141, 271. Foundations of affine geometry, the geometry of quadratic forms. Structure of the general linear group, symplectic groups, and orthogonal groups.
480. **Seminar in Topology.** I, II. 1-12 hr.
497. **Research.** 1-15 hr.

Astronomy

Astron.

216. **Astronomy for Teachers.** S. 3 hr. Introduction to astronomy with special emphasis on the needs of physical science teachers and science club directors. Not open to students with credit for Astronomy 106.
255. **Mathematical Astronomy.** II. 3 hr. PR: Astron. 106, Math. 16. Development of the implications of Kepler's Laws and Newton's Law of Gravitation.

PHILOSOPHY

Acceptance of a student will be based on (1) a Bachelor of Arts Degree with a minimum grade-point average of 3.0; (2) references from persons who can attest to, and advise on, the appli-

cant's ability to complete the degree program. It is desirable, but not required, that the student also submit his score on the Graduate Record Examination.

The M.A. Degree

To obtain the Master of Arts degree in Philosophy, (1) a minimum of 30 semester hours of course work beyond the bachelor's degree is required; (2) a reading knowledge of some foreign language, preferably French or German, is required; (3) a comprehensive examination in the areas of the History of Philosophy, Logic, Ethics, and Theory of Knowledge must be passed; (4) a thesis must be submitted, or, at the discretion of the Department of Philosophy, a written examination in the candidate's special field must be passed; and (5) an oral examination must be passed.

An average grade no lower than "B" in all courses taken at the graduate level is required.

Philosophy

Philos.

- 206. **Mathematical Logic II.** II. 3 hr. PR: Philos. 106 or consent. Formalization of the material in the previous terms, the concepts of consistency, decidability, and completeness (equiv. to Math. 261).
- 223. **Philosophy of Religion.** I or II. 3 hr. PR: Philos. 123 or consent. Advanced topics in the philosophy of religion.
- 250. **Social and Political Philosophy.** I or II. 3 hr. PR: Philos. 150 or consent. Advanced topics in social and political philosophy.
- 253. **Philosophy of Mathematics.** I or II. 3 hr. PR: Philos. 106 or consent. Contemporary viewpoints in the foundations of mathematics.
- 264. **Empiricism.** I or II. 3 hr. Philos. 102. Locke, Berkeley, and Hume.
- 268. **Rationalism.** I or II. 3 hr. PR: Philos. 102. Descartes, Spinoza, and Leibniz.
- 289. **Advanced Topics in Logic.** I or II. 3 hr. PR: Philos. 206 or consent.
- 302. **Philosophy of Science.** I or II. 3 hr.
- 303. **Theory of Knowledge.** I or II. 3 hr.
- 304. **Symbolic Logic.** I or II. 3 hr.
- 305. **History of Philosophy.** I or II. 3 hr.
- 306. **Metaphysics.** I or II. 3 hr.
- 310. **Ethics.** I or II. 3 hr.
- 321. **Seminar: Selected Topics.** 3-9 hr.
- 497. **Research.** 1-15 hr.

PHYSICS

The Department of Physics offers studies leading to the degrees of Master of Science and Doctor of Philosophy in both experimental and theoretical physics with research concentrations in solid state, nuclear, atomic, and high energy physics, as well as to the areas of optics, electromagnetism, gravitation, and air pollution. The degree of Doctor of Philosophy requires completion of a research project upon which a dissertation is based. The Master of Science degree requires the writing of a thesis based on research project or a study involving the history or teaching of physics.

The general Graduate School requirements for a graduate degree are stated elsewhere in this bulletin. Graduate students in the M.S. program must receive credit for a minimum of 30 semester hours of course work as approved by the student's adviser. A 3.0 grade-point average is required. The 30 hours may include no more than 6 hours of research credit and do not include any courses which are taken to remove deficiencies in the student's undergraduate background. In addition to course work, a satisfactory performance on a written examination, completion of a thesis, and a final oral examination are required.

In general, to be admitted to the program for the Doctor of Philosophy, a student must pass a written admission examination. The program consists of basic graduate courses and specialized graduate courses related to a specific area of research. To complete the requirements for the degree, the student must demonstrate reading proficiency in one foreign language (French, German, or Russian), complete such courses as required by the department, pass the qualifying examination, submit an approved dissertation, and successfully defend his dissertation in a final oral examination.

Full details concerning the M.S. and Ph.D. programs may be obtained from the Department of Physics.

PHYSICS

- 201, 202. **Special Topics.** I, II. 1-3 hr. per sem. PR: Consent. Directed or independent study of topics of current interest in physics.
- 221. **Optics.** II. 3 hr. PR: Calculus, Physics 11, 12 or equiv. A basic course in physical optics covering radiation theory, diffraction, interference, polychromatic waves, scattering, polarization, double refraction, and selected topics in quantum optics.
- 225. **Atomic Physics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Relativistic mechanics, atomic structure and spectra.
- 231, 232. **Theoretical Mechanics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Scalar and vector fields, curvilinear coordinate systems, kinematics of particle motion. Systems of particles, rigid body motion, conservative motion, central force fields, constraints. Lagrangian and Hamiltonian methods, oscillations, coupled oscillators.

- 233, 234. **Intermediate Electricity and Magnetism.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Electrostatics, magnetostatics, introduction to electrodynamics, and applications.
- 241, 242. **Mechanics Laboratory.** I, II. 1 hr. per sem. Experiments in mechanics; vibrations, damped oscillations, viscosity, thermal expansion. Determination of mechanical constants, g , γ , Young's, and shear moduli.
- 243, 244. **Electricity Laboratory.** I, II. 1 hr. per sem. Experiments with electric and magnetic fields, electric and magnetic properties of materials, electromagnetic oscillations, waves, and radiation. Experience with electric and magnetic instruments and devices.
- 245, 246. **Modern Physics Laboratory.** I, II. 1 hr. per sem. Experiments in atomic, nuclear, and solid state physics. Emphasis is placed upon the learning of some of the techniques of experimental physics, methods of data evaluation, and error analysis.
- 247, 248. **Physics Seminar.** I, II. No credit. Suggested for junior, senior and graduate physics majors. This program of lectures acquaints students with topics of current interest in physics.
249. **Optics Laboratory.** I. 1 hr. PR: Physics 11, 12 or equiv. Experiments in interference, diffraction, polarization, optical pumping, geometrical optics, and holography. Experience in using simple optical instruments.
251. **Introductory Quantum Mechanics.** I. 3 hr. PR: Physics 225 (or 231, 232). Physical observables as operators. Operator equations, particularly the Schrodinger equation. Applications to one dimensional motion, the harmonic oscillator, atomic structure and spin. Equation of motion.
252. **Introductory Quantum Mechanics.** II. 3 hr. PR: Physics 251. Approximate methods of calculation. Theory of scattering, radiation. Applications to atomic, molecular, nuclear, and solid state physics.
263. **Nuclear Physics.** I, II. 3 hr. PR: Calculus, Physics 11, 12 or equiv., Physics 225. The study of the characteristic properties of nuclei and their structure as inferred from nuclear decays and reactions, leading to a knowledge of nuclear forces and models.
- 271, 272. **Solid State Physics.** I, II. 3 hr. PR: Physics 225, or 125, 126. An introductory study of the properties of crystalline solids; includes crystal structure, binding, lattice vibrations and an investigation of thermal, electrical, magnetic, and optical phenomena based on the energy band theory.
283. **Thermodynamics.** I. 3 hr. PR: Calculus, Physics 11, 12 or equiv. The application of the fundamental laws of thermodynamics to physical and chemical systems.
284. **Kinetic Theory.** II. 3 hr. PR: Calculus, Physics 11, 12 or equiv. Introduction to the concepts of probability which lead to the derivation of the Boltzman, Fermi-Dirac, and Bose-Einstein statistics. The application of these statistics to physical and chemical systems.
- 287, 288. **Introduction to Mathematical Physics.** I, II. 3 hr. per sem. PR: Calculus, Physics 11, 12 or equiv. Introductory treatment of orthogonal functions, Laplace transforms, Green's function, coordinate transformations, elasticity, and hydrodynamics.
- 303, 304. **Special Topics.** I, II. 1-3 hr. per sem. PR: Consent. Specialized topics of current interest in physics.

313. **Introductory Electronics.** S. 3 hr. PR: 1 year of college physics. Primarily for Education majors; not for graduate credit for science majors.
318. **Dynamic Meteorology.** II. 3 hr. PR: Calculus, Physics 117 or equiv. Dynamics of lower atmosphere relating to transport and dispersion of foreign matter.
- 331, 332. **Advanced Classical Mechanics.** I, II. 3 hr. PR: Physics 233, 234, and differential equations. (Taught in alternate years). Lagrange and Hamilton form of equations of motion, rigid bodies, small and non-linear oscillations. Transformation theory, relativistic dynamics, and systems with an infinite number of degrees of freedom.
- 333, 334. **Advanced Electricity and Magnetism.** I, II. 3 hr. PR: Physics 233, 234, and differential equations. (Taught in alternate years). Electrostatic and magnetostatic boundary value problems. Maxwell's equations for time varying fields. Green's functions and integral representations; applications to radiation, diffraction, wave guides, plasma physics, and relativistic motion of charged particles.
- 341, 342. **Research Seminar.** I, II. 3 hr. PR: Consent. Discussion of problems encountered in particular fields of research and their relation to other areas of physics.
- 351, 352. **Quantum Mechanics.** I, II. 3 hr. per sem. PR: Physics 225 and 251. This course covers a wide range of topics of current interest at a level such that a student should be able to read basic research papers in many fields upon completion. Topics covered are: approximation methods, representation theory, angular momentum, relativistic quantum mechanics, time dependent perturbation theory, identical particles, scattering, molecules, solids, magnetism, and second quantization of bosons and fermions.
354. **Outline of Modern Physics.** S. 3 hr. PR: 10 hr. of college physics, 1 year of college math. Selected topics in modern physics. Primarily for Education majors; not open to physics majors.
- 355, 356. **Workshop for Physics Teachers.** SI, SII. 3 hr. per sem. PR: 1 year of college physics, 1 year of college math. Techniques of apparatus construction and demonstration. Primarily for Education majors; not open to physics majors.
357. **Photography.** SI. 3 hr. PR: 1 year of college physics or equiv. The physics and chemistry of photography with practical experience. Primarily for Education majors; not open to physics majors.
358. **Light.** SII. 3 hr. PR: 1 year of college physics or equiv. A demonstration course designed to illustrate the basic concepts covering light and optics. Primarily for Education majors; not open to physics majors.
- 361, 362. **Molecular Physics.** I, II. 3 hr. per sem. PR: Physics 225. A presentation of the theory of molecular structure and spectra.
410. **High Energy Physics.** I. 3 hr. PR: Physics 351, 352. Field theoretical interpretation of fundamental particles, interacting systems, S-matrix expansions, Feynman diagrams, and renormalization theory.
- 425, 426. **Atomic and Molecular Physics.** I, II. 3 hr. per sem. PR: Physics 225, 351, and 352. (Taught in alternate years). Hartree-Fock theory application of angular momentum operators; group theory and j-symbols; Dirac theory; molecular vibrations; Breuckner-Goldstone applications to atomic structure, current topics.

453. **Advanced Quantum Mechanics. I.** 3 hr. PR: Physics 351, 352. Study of relativistic theory, many electron systems, introduction to quantum electrodynamics. (Taught in alternate years).
- 463, 464. **Advanced Nuclear Physics. I, II.** 3 hr. per sem. PR: Physics 225, 263, and 251. Theory of nuclear forces, transformations and energy levels. (Taught in alternate years).
- 471, 472. **Advanced Solid State Physics. I, II.** 3 hr. per sem. PR: Physics 271, 272, and 351. Detailed presentation of the theories of solids and its application to various topics: semiconduction, magnetism, etc. (Taught in alternate years).
483. **Statistical Mechanics. II.** 3 hr. PR: Physics 283, 351, 352. Classical statistics; Boltzman, Fermi-Dirac and Bose-Einstein statistics, theory of fluctuations and applications to physical systems. (Taught in alternate years).
487. **Advanced Mathematical Physics. I.** 3 hr. PR: Physics 351 and 352. Mathematical techniques applied to problems in physics: group theory, functions of a complex variable, linear integral equations, geometry of finite dimensional vector spaces.
497. **Research. I, II.** 1-15 hr.

POLITICAL SCIENCE

The graduate program in political science at West Virginia University extends through the Doctor of Philosophy degree. With reference to departmental objectives, the emphasis is placed upon more extensive and intensive training than is possible on the undergraduate level. This involves: (1) the development of a broader knowledge of the literature of political science; (2) some degree of specialization in one of the major areas of the disciplines; and (3) training in the identification and analysis of problems in governmental theory and practice. Graduate work in political science contributes to a general education and provides the foundation for more advanced work in the field. Leading professional possibilities for political science majors include teaching, the public service, and preparation for the legal profession.

The Degree of Master of Arts

Eligibility. Regular applicants for the Master of Arts degree should present a minimum of 12 semester hours of undergraduate credit in political science and at least 6 additional hours in some cognate field, including history, economics, sociology, psychology, or social work. Students who do not meet the minimum requirements may, after consultation with the adviser, be admitted conditionally. In addition, a grade-point average of 2.5 should have been maintained as an undergraduate.

"Special" graduate students who are not working for an advanced degree may be admitted to courses for which they can satisfy the prerequisites.

Course Requirements. Admission to candidacy for the Master of Arts degree in political science is conditioned upon the completion of at least 30 hours of graduate work including a thesis. The candidate should present 18 semester hours of graduate course work in political science and 6 hours of similar work in a cognate field, such as economics, history, sociology, psychology, social work or education. Exceptions to this general rule may be made by the departmental adviser in the case of students with an inadequate background in political science who transfer from other institutions or from other departments in West Virginia University. Normally the thesis will carry 6 hours credit. A reading knowledge of a foreign language is highly desirable. Pol. Sci. 200 or Pol. Sci. 400 is required of everyone enrolled in the Master of Arts program.

Thesis and Final Examinations. In his graduate program, the student will write a thesis on a subject falling within his field of specialization. Fulfillment of the thesis requirement includes the following steps: (1) selection of a problem or topic for research in the problem area; (2) extensive reading and collection of data in the problem area; (3) organization, analysis, and evaluation of the data; (4) writing the thesis in correct form; (5) acceptance of the completed thesis by a committee composed of at least three faculty members, one of whom shall not be a member of the Department of Political Science, and (6) passing an oral or written examination or both, administered by the committee on the thesis and the major and minor field.

Research on the thesis project will be done under the supervision of a staff member in whose field of specialization the thesis problem falls.

Students who fail to pass the final examination may appear for a second examination not earlier than the semester following that in which the first examination was given. It is contrary to departmental policy to give a third examination.

The Degree of Master of Public Administration

This is a professionally oriented program designed to provide graduate professional training for administrative careers in the public service. The curriculum is designed to enable the student to understand and apply concepts and methods of the social and behavioral sciences to the development of public policies and the operation of governmental programs. The M.P.A. program seeks: (1) to provide orientation to the environment of public administration with particular attention to political institutions and processes; (2) to convey a general understanding of the major processes of public administration including program planning, organizational dynamics and leadership; and (3) to offer an opportunity for specialization in major managerial functions includ-

ing financial administration, personnel administration, and organizational design.

Eligibility. Applicants for the Master of Public Administration degree must have a B.A. or B.S. degree with an overall grade-point average of at least 2.5. A student admitted to the program who has not had undergraduate courses in public administration will be expected to correct the deficiency prior to beginning graduate work by completing a special list of readings on which he will be examined orally.

Course Requirements. The student will be required to complete 36 hours of course and seminar work. A grade-point average of 3.0 will be required for graduation. Although a thesis is not required, the program of each student must include a minimum of four courses in which substantial research papers are required.

Tool Requirements. Candidates for the degree must demonstrate basic competence in either statistics or accounting by successfully completing an approved course in West Virginia University or another academic institution, or by passing an examination.

Qualifying Examination. During the last term of study, students in the M.P.A. program must pass a comprehensive examination for the degree. This examination will cover the core courses of the program and the elective courses selected.

The Degree of Doctor of Philosophy

To gain admission to the program leading to the Doctor of Philosophy degree applicants must have completed the requirements for a master's degree, or the equivalent, at an approved institution as well as have demonstrated a capacity for graduate work in the Graduate Record Examination.

The program of courses will depend upon the individual needs of the student and the extent of his previous training in political science and related fields. Work leading to the doctoral degree consists of a minimum of three full years of graduate study—at least 60 semester hours after the bachelor's degree, in addition to research for the dissertation. Credits completed for a master's degree may be included in the doctoral program, with the exception of research credit granted for the master's thesis. Only credits with a grade of B or better in political science courses and C or better in the minor are accepted. A minimum of 36 hours or its equivalent in residence in full-time graduate study at West Virginia University is required.

With the approval of his adviser, a prospective candidate selects: (A) four major areas in the field of Political Science from the following six offered by the Department: (1) American National, State and Local Government; (2) Politics and Policy Development; (3) Public Administration; (4) Foreign and Comparative Government; (5) International Relations, Organizations, and

Law; and (6) Political Theory; and (B) a minor area in a related field. At least one year prior to the conferring of the degree and after maintaining at least a 3.0 average in the major field and a 2.0 average in the minor, a prospective candidate is formally admitted to candidacy for the doctor's degree upon satisfactorily passing written and oral examinations in the four major areas and the minor. To be eligible for these examinations, the prospective candidate must have demonstrated competency in two languages other than English (normally French and German) through examinations conducted by the Foreign Language Examiner for the Graduate School. Competency in statistics as evidenced by 6 hours with a grade of "C" or better in 200-, 300-, or 400-level statistics courses may be substituted for one language.

Upon admission to candidacy for the Doctor of Philosophy degree, the candidate must select a topic for a dissertation under the direction of his adviser, complete a dissertation which makes a contribution to knowledge in the candidate's area of concentration, and pass a final examination based primarily upon the dissertation. After successful completion of the final examination, the candidate will be recommended for the degree.

Political Science

Pol. Sci.

200. **Research Materials and Techniques in Political Science.** I. 3 hr. A study of basic source materials in political science and of the techniques and methods of governmental research.
211. **Problems of American National Government.** II. 3 hr. This course is intended to give recognition to the major contemporary problems of government. Extensive reading of background materials as well as current literature in the field.
213. **American Constitutional Law.** I. 3 hr. PR: Pol. Sci. 2 or consent. Basic principles of American constitutional law as developed through interpretation with special emphasis on constitutional theories and national development. Primarily for seniors and graduate students.
214. **Civil Rights and Liberties in the United States.** II. 3 hr. PR: Pol. Sci. 213 or consent. Study of the scope and meaning of civil liberty guarantees in the United States Constitution, as illustrated by cases involving original constitutional provisions, the federal Bill of Rights and Civil War Amendments with special attention to the rule of law; free speech, press, religion, assembly, and petition; personal security; racial discrimination; and the labor problems.
215. **American Constitutional Development I.** I. 3 hr. PR: Pol. Sci. 2 or consent. A survey of American constitutional development, with special emphasis on the origins of constitutionalism here; liberty vs. government; mixed government; separation of powers; the problem of federalism and the Philadelphia Convention of 1787; the Marshall court and establishment of judicial review; Federalist vs. States Rights construction of the Constitution; Jacksonian influences; the Taney Court prelude to the Civil War, secession, and conflict, heralding constitutional change.
216. **American Constitutional Development II.** II. 3 hr. PR: Pol. Sci. 2, 215 or consent. Continuation of a survey in American constitutional develop-

- ment, with special attention to reconstruction, the Supreme Court, and the Fourteenth Amendment; *laissez-faire* and the commerce clause; stirrings of reform toward a constitutional revolution under the New Deal; changing federal-state relationships; the impact of war upon constitutional interpretation; an expanding role for the president in domestic matters and foreign relations; the Warren court and triumph for libertarian activists over judicial restraintists in an era of civil liberties.
218. **Government and Business.** II. 3 hr. PR: Pol. Sci. 2 or consent. An examination of government regulations of the economy dealing with the origin and development of public policies, constitutional and political basis of regulation, relationships between political and economic institutions and processes, and an evaluation of the consequences of regulatory policies.
 221. **West Virginia Government and Administration.** I, II. 3 hr. A study of the organization and operation of the state government of West Virginia.
 225. **Municipal Government.** I. 3 hr. Legal basis, structure, operation, and problems of municipal government and municipal relations with other governmental units.
 226. **Problems of State and Local Government.** II. 3 hr. An examination of current problems of state, county, and municipal governments. Students are expected to have completed Pol. Sci. 120 or its equivalent.
 231. **History of Political Parties.** I. 3 hr. An examination of the growth of political parties in the United States. Analysis of issues in presidential campaigns as they relate to political party development. Offered in odd-numbered years.
 232. **Public Opinion and Propaganda.** II. 3 hr. Analysis of techniques of sampling and measuring public opinion; detection of propaganda; the nature of propaganda and methods of the propagandist. Offered in alternate years.
 233. **Current Political Issues.** I. 3 hr. An examination of political party platforms and the major issues of the political campaign. Students will be expected to examine background materials thoroughly. Offered in even-numbered years.
 234. **The Legislative Process.** II. 3 hr. Structure and organization of legislative bodies. Powers of legislature. Detailed study of law-making procedures. The influence of outside forces. Offered in alternate years.
 244. **Administrative Law and Regulations.** II. 3 hr. PR: Pol. Sci. 140 or consent. Study of the law of administration, primarily by the case method, covering administrative powers, procedure in administrative adjudication and rule-making, discretion, judicial control, and administrative liability.
 246. **Comparative Public Administration.** II. 3 hr. The theory and practice of public administration in diverse cultures and national political systems.
 251. **Modern Dictatorships.** II. 3 hr. Politically undemocratic governments. Provides background of dictatorship generally, followed by treatment of several modern dictatorships.
 252. **British Government and Politics.** II. 3 hr. Intensive study of British government with emphasis upon both internal and external policies, primarily during the twentieth century.
 253. **Contemporary Governments of the Commonwealth.** II. 3 hr. Analysis of the political relationships between the members of the Common-

wealth and a comparative study of the governments of the Dominions with particular reference to Canada and Australia.

254. **Governments of Asia.** I. 3 hr. Survey of political institutions and governmental processes of Japan, China, and India with a special emphasis on the analysis of contemporary political problems of the governments surveyed.
255. **Governments of Latin America.** I. 3 hr. Comparative study of the major nations of Latin America.
256. **Governments of the Middle East.** II. 3 hr. The governments and political forces of the Middle East.
257. **Governments of Southeast Asia.** II. 3 hr. Survey of political institutions and governmental processes of the Southeast Asian countries with a special emphasis on the analysis of contemporary political problems of the governments surveyed.
258. **Politics of Africa.** I. 3 hr. A survey of the historical legacies and current political processes of tropical African countries designed primarily for secondary-level social studies teachers who are pursuing graduate training.
259. **Political Tour of Europe.** 6 hr. PR: Pol. Sci. 1 and 2 or consent. Examination of governments and politics in selected European countries. Lectures and discussions supplement observation while visiting these countries.
261. **International Organization.** I. 3 hr. PR: Pol. Sci. 160 or consent. Emphasis will be placed upon agencies created since the close of World War II. Some reference to development of international law and League of Nations.
263. **Public International Law.** I. 3 hr. Law governing relations among nations, including development of rules, means of enforcement, and conflicts between theory and practice.
264. **Conduct of American Foreign Relations.** I. 3 hr. Basic concepts about and factors influencing the decision-making process and the conduct of United States foreign policy, with special attention to the problems of ends and means of a democracy, pressure interest groups (i.e. the military-industrial complex and the administrative bureaucracy); recent theories, analytical tools, and methodology in the problem areas of conflict-resolution, nonconsensus situations, and inter-nation influence; regional patterns, problems, and prospects of United States policy in Europe, Africa, Asia, the Middle East, and the Soviet bloc since 1945.
265. **Basic Factors in Power Politics.** II. 3 hr. PR: Pol. Sci. 2 or consent. Analysis of factors of power in the nation-state system. Evaluation of nationalism and concepts of national interest in modern world politics.
266. **Soviet Foreign Policy.** I. 3 hr. PR: Pol. Sci. 150 or 160 or consent. Basic concepts about and factors influencing choice in the formulation and execution of Soviet foreign policy; the development and present patterns in Soviet foreign relations with key states and the United Nations; possible problems and prospects in further Soviet relations.
267. **Latin America in International Affairs.** II. 3 hr. PR: Pol. Sci. 160 or 255 or consent. Survey of the relations of Latin American States among themselves, with the United States of America, with the United Nations, with regional organizations, and with non-Western States. Analysis in

depth of the Monroe Doctrine and its corollaries, and the Inter-American system.

268. **Inter-States Conflict in International Affairs.** II. 3 hr. PR: Pol. Sci. 160 or consent. The study of conflict in inter-state relations, in particular armed conflict between nations. Attention to the role of force, the impact of modern technology and nuclear weaponry, theoretical and research approaches to the causes and nature of conflict, and different modes of conflict control and resolution.
269. **Far Eastern International Relations.** II. 3 hr. PR: Pol. Sci. 160 or 254 or consent. A survey of the international relations of the Far Eastern countries with emphasis on the historic roots of recent conflicts, the competitive role of the United States and the Soviet Union, confrontation between the Communist and anti-Communist countries in the region, and the regional cooperation and security problems in the post-war period.
270. **History of Political Thought: Plato to Machiavelli.** I. 3 hr. Examination of major political ideas from the Greeks to sixteenth century with special emphasis upon development of natural law and western conception of justice.
271. **History of Political Thought: Machiavelli to Bentham.** II. 3 hr. PR: Pol. Sci. 270 or consent. Analysis of the political ideas which developed from the separation of faith and reason, the culmination of this movement in rational integral liberalism, and the origins of modern conservatism as expounded by Edmund Burke.
272. **Recent and Contemporary Political Thought.** I. 3 hr. An examination of integral liberalism and the forces leading to the decline of liberalism and a critical analysis of the Fascist and Communist ideologies with their threat to the traditions of western civilization embodied in Christianity and conservatism.
275. **Foundations of Jurisprudence.** II. 3 hr. A multiphase inquiry into: (a) the nature, end, and sanctions of law; its sources, forms, and modes of growth, as evidenced in typical legal systems; general juristic conceptions of rights, duties, and liabilities as well as persons, acts, and things; (b) the main schools of jurisprudence—analytical, historical, philosophical, sociological, and that of legal realism; (c) the economic interpretation of law and its relation to property and interest; (d) the problem of legal rule versus discretion; (e) the meaning of obligation, with special reference to contract; (f) stages in the development of legal institutions, forms and procedures (as exemplified in trials); (g) significant theories about law; and (h) the status of law in today's world.
290. **Socio-Politics of Africa.** I. 3 hr. A comparative inquiry into political behavior and its social bases in tropical Africa, with particular reference to eastern and central Africa.
295. **The Politics of Planned Development.** II. 3 hr. A comparative study of the political aspects of directed economic and technological change, with special reference to the politics of national development planning and the development process.
310. **American Political Institutions.** I. 3 hr. PR: Pol. Sci. 2 or consent. Development of the Constitution, Congress, the Presidency, and the Supreme Court as institutions with special attention to current problems and issues.
341. **Administrative Organization and Management.** I. 3 hr. PR: Pol. Sci. 140 or consent. Analysis of governmental administrative organization and

reorganization and of such management functions as leadership, planning, coordination, public relations, and management improvement.

343. **Public Personnel Administration.** II. 3 hr. PR: Pol. Sci. 140 or consent. A survey of public personnel administration with particular attention to the merit system concept, career staffing, classification and salary administration, selection, manpower utilization, training, the rights and duties of employees, and the relationship between management and personnel specialists. Emphasis is given to psychological and human relations aspects of the work situation with attention to role and status, motivation, leadership, employee relations, and supervisor-subordinate interaction.
345. **Public Administration and Policy Development.** II. 3 hr. PR: Pol. Sci. 140 or consent. Analysis of decision-making and policy development in the administrative process by the case method.
350. **Comparative Government.** I. 3 hr. A comparative study of modern political institutions with particular attention to European constitutional government and politics.
373. **American Political Theory.** II. 3 hr. PR: Pol. Sci. 271 or consent. A survey of major political ideas and their influence upon American society and government from the seventeenth century to the present. Offered in alternate years.
374. **Problems in Contemporary Political Thought.** II. 3 hr. An intensive study of current trends in political thought through examination of the works of contemporary writers. Offered in alternate years.
391. **Leadership and Authority in Africa.** II. 3 hr. A comparative study of traditional, colonial, and contemporary political leadership and authority patterns in Africa south of the Sahara.
394. **The Theory of Political Development.** I. 3 hr. A survey of contemporary theories concerning political change and the relationship of political change to economic and technological development with particular reference to the new nations.
400. **Scope and Methods of Political Science.** II. 3 hr. PR: Pol. Sci. 200 or consent. An investigation into the permissible scope and methods of empirical political science, with particular reference to the conceptual and technical problems of basic research in political behavior. Required of doctoral majors.
403. **Internship.** I, II. 6-9 hr. per sem.; students may enroll more than once. PR: Consent. A work internship in government or political agencies designed to give students actual experience in a particular field of political science.
- 410, 411. **Directed Reading and Research in American National Government.** I, II. 2-4 hr. per sem.; students may enroll more than once.
419. **Seminar in American National Government.** I. 3 hr. PR: Consent.
- 420, 421. **Directed Reading and Research in State Government.** I, II. 2-4 hr. per sem.; students may enroll more than once.
- 425, 426. **Directed Reading and Research in Local Government.** I, II. 2-4 hr. per sem.; students may enroll more than once. PR: Pol. Sci. 225 or consent.
429. **Seminar in State and Local Government.** I. 3 hr. PR: Consent.

- 430, 431. **Directed Reading and Research in Politics.** I, II. 2-4 hr. per sem.; students may enroll more than once. PR: Pol. Sci. 130 or consent.
439. **Seminar in Politics and Policy Development.** I. 3 hr. PR: Consent.
- 440, 441. **Directed Reading and Research in Public Administration.** I, II. 2-4 hr. per sem.; students may enroll more than once. PR: Pol. Sci. 140 or consent.
442. **American Administrative Systems and Processes.** II. 3 hr. PR: Pol. Sci. 140 or consent. Analysis of the nature and processes of American public administration (political, legal, economic, and social conditions)—followed by a survey of organization, planning, budgeting, and personnel as the basic elements of an administrative system.
443. **Public Financial Administration.** I. 3 hr. PR: Pol. Sci. 140 or consent. An examination of the principal subjects of financial administration and their interrelationships. Particular attention is given to revenue systems, treasury and debt management, financial controls and inter-governmental fiscal relations.
444. **Public Program Planning.** II. 3 hr. PR: Pol. Sci. 140 or consent. A study of the design and management of governmental administrative systems. Special attention is given to systems theory, methods of system analysis, communications, management controls and methods of program evaluation.
445. **Public Budget Formulation and Execution.** II. 3 hr. PR: Pol. Sci. 140 or consent. The budget as a focus of policy formulation and an instrument of controlling the work program. The process of budget creation and administration. The form of the budget. Budgetary practice in American governments.
446. **Public Program Seminar.** S. 6 hr. PR: Pol. Sci. 140 or consent. An analysis through case studies of the application of administrative processes to a major public problem. Students in the course are expected to produce substantial research papers on selected public problems.
449. **Seminar in Public Administration.** II. 3 hr. PR: Consent.
- 450, 451. **Directed Reading and Research in Comparative Government.** I, II. 2-4 hr. per sem.; students may enroll more than once.
459. **Seminar in Comparative Government.** II. 3 hr. PR: Consent.
- 460, 461. **Directed Reading and Research in International Relations.** I, II. 2-4 hr. per sem.; students may enroll more than once.
469. **Seminar in International Relations.** II. 3 hr. PR: Consent.
- 470, 471. **Directed Reading and Research in Political Theory.** I, II. 2-4 hr. per sem.; students may enroll more than once.
479. **Seminar in Political Theory.** II. 3 hr. PR: Consent.
480. **Thesis.** I, II. 2-6 hr.
497. **Research.** 1-15 hr.

PSYCHOLOGY

Admission. Except in unusual circumstances, students are admitted only at the beginning of the Fall semester. Applications must be completed by the preceding February 15. Acceptance of

the student will be based on: (1) adequate academic aptitude at the graduate level as measured by the Graduate Record Examination; (2) a minimum grade-point average of 2.5 (C+); (3) personal qualities in the applicant which are predictive of success in graduate study and satisfactory professional placement after graduation; (4) adequate preparation in the biological and social sciences, experimental psychology, and statistics. By permission, deficiencies in preparation may be made up after admission to the department. Students are expected to maintain a 3.0 (B) average in their psychology courses during the first graduate year, and to present a final 3.0 average in all psychology courses attempted.

Special Graduate Students. Graduate courses in psychology are open only to regular graduate students except by special departmental permission.

The Master of Arts Degree (M.A.). Two years of full-time study with a minimum of 48 hours of credit are required for the M.A. degree. Six hours of credit may be counted for the M.A. thesis if such thesis is required by the option chosen by the student. The following options are available for the M.A. degree:

1. *Intermediate Degree for Ph.D. Candidates.* Students who are candidates for the Ph.D. are expected to complete an M.A. thesis and will receive the M.A. degree upon completing the thesis and credit hour requirements.

2. *Psychological Research Technician.* This option will prepare the student to become a skilled research technician in behavioral sciences research programs. A thesis and broad training in research methodology and statistics will be required for this option.

3. *Teaching of Psychology at the Undergraduate Level.* No thesis is required under this option but supervised teaching at the college level is expected as part of the student's preparation.

4. *Professional M.A. Degree in Clinical Psychology.* This program prepares the student for work in hospitals, mental health clinics, school mental health programs, and the like. No thesis is required but the student must fulfill a field placement requirement during the summer intervening between the first and second year of graduate study. (An additional 12 hours of work in education will qualify students in this program for provisional certification as school psychologists in West Virginia).

The Doctor of Philosophy Degree (Ph.D.). The doctoral programs aim to prepare a small number of well-qualified psychologists for three types of careers: (1) teaching and research in experimental psychology (with emphasis on learning), (2) teaching and research in life-span developmental psychology, and (3) teaching, research and practice in clinical psychology. All doctoral programs require an academic year of supervised college teaching. A calendar year in an approved internship setting is required of all clinical students.

Students are accepted for study toward the Ph.D. objective upon entry into the department. They are formally admitted to doctoral study only after completion of the master's degree or its equivalent and may be subject to a screening examination to determine their readiness for doctoral work. During the first year of graduate work beyond the master's degree and after demonstrating reading knowledge of a foreign language, the student will be admitted to a comprehensive preliminary examination in which he must demonstrate competence in his major area of specialization and a knowledge of such other areas of psychology as may be required of all graduate psychology students.

Upon passing the preliminary examination, the student will be formally promoted to candidacy for the doctorate. He will then be assigned a committee which will direct his further course work and his dissertation research, and will approve his internship setting.

After completion of a satisfactory dissertation and all other requirements, the candidate will take a final examination, written or oral, over his major emphasis and the dissertation.

Psychology

Psych.

201. **Personnel Psychology.** I or II. 3 hr. PR: Psych. 1 and Stat. 101 or equiv. Application of psychological principles and techniques to the problems of measurement and prediction of proficiency in industry and society. Topics include proficiency measurement, personnel selection by test and interviews, conditions of work and productivity, engineering psychology, work methods, and safety.
202. **Job Analysis.** I or II. 3 hr. PR: Psych. 201 or consent. Instruction and supervised practice in the preparation of job analysis and in the use of occupational descriptions. Of interest to students in psychology, guidance, engineering, management, and rehabilitation counseling.
213. **Directed Studies.** I, II, S. 1-3 hr. per sem. PR: Written consent. Individually supervised reading, research and/or classroom management projects. (Graduate psychology students should register for such projects under Psych. 313.)
219. **Survey of Psychology.** I. 1 hr. PR: Senior standing. Overview of modern psychology with special reference to problems of graduate and professional training. Of primary interest to psychology majors and/or graduate students in other fields who are considering graduate work in psychology.
242. **Infant Behavior.** I or II. 3 hr. PR: 9 hr. of psychology including Psych. 141 or CDFR 141, 142 or graduate standing. Systematic investigation of the basic areas of human development during the first years of life. Topics such as infant motor development, conditioning and learning, language development, sensory and motor processes will be examined.
243. **Child Behavior.** I or II. 3 hr. PR: 9 hr. of psychology including Psych. 141 or CDFR 141, 142 or graduate standing. An examination of the literature in experimental child psychology including growth trends in behavior in the physical, intellectual, emotional, social, and personality areas.

244. **Adolescent Behavior.** I or II. 3 hr. PR: 9 hr. of psychology including Psych. 141 or CDFR 141, 142 or graduate standing. Psychosexual, psychosocial, and other focal problems of development during adolescence are stressed. Cultural influences such as compulsory education, social movements, delinquency, sex roles, and drug abuse are discussed in the context of adolescent development.
245. **Adult Behavior.** I or II. 3 hr. PR: 9 hr. of psychology including Psych. 141 or CDFR 141, 142 or graduate standing. Cognitive and personality changes from maturity to old age. Psychological reactions to physiological change and to the establishment and dissolution of family units. Problems of intergenerational differences in adult behavior.
253. **Attitudes and Propaganda.** I or II. 3 hr. PR: Psych. 151 or consent. The nature of attitudes and opinions, attitude measurement, opinion changing, propaganda use and analysis, the social psychology of mass media, democratic values, and public opinion. Of interest to students in psychology, sociology, political science, and journalism.
262. **Group Psychometric Testing.** I or II. 3 hr. PR: Psych. 1 and Stat. 101 or equiv. Theory underlying the construction and use of psychometric measurement techniques for evaluating aptitudes, interests, attitudes, and personality.
263. **Introduction to Personality.** I, II, S. 3 hr. PR: 9 hr. of psychology or graduate standing. The development and significance of the personality concept in psychology including a survey of the major theories such as psychoanalytic, interpersonal, trait, and learning.
264. **Psychology of Adjustment.** I, II, S. 3 hr. PR: 9 hr. of psychology or graduate standing. Dynamic principles of human personality adjustment. Primarily for non-majors. Not open to students who have completed Psych. 164.
271. **Introduction to Clinical Psychology.** I or II. 3 hr. PR: 9 hr. of psychology or graduate standing. Review of concepts, techniques, and professional roles in clinical psychology. Of interest to advanced undergraduates and graduates in education, guidance, personnel, pre-medicine, and social work, as well as professional-oriented students in psychology.
281. **Abnormal Psychology.** I and II. 3 hr. PR: 9 hr. of psychology or graduate standing. Survey of the major behavioral disorders; neurosis, psychosis, and character disorders. Emphasis is placed on the developmental dynamics leading to these disorders, and upon their psychological treatment.
282. **Exceptional Children.** I or II. 3 hr. PR: 9 hr. of psychology including Psych. 141 or CDFR 141 or 142 or graduate standing. Study of children who present psychological problems because of: (1) exceptional mental retardation or advancement; (2) organic disabilities having behavioral consequences, such as cerebral palsy or deafness; (3) disorders of conduct associated with a typical personality functioning. Of special interest to those who regularly deal with children, such as teachers, guidance counselors and nurses.
304. **Leadership and Human Relations in Working Groups.** I or II. 1-3 hr. PR: Consent. Individual work related to either research or practice in the field of human relations training programs.
307. **Practicum in Industrial Interviewing.** I or II. 3 hr. PR: Psych. 201 or consent. An intensive review of principles of selection and validation as they relate to the interview. Practice interviews applying non-direc-

tive techniques in employment and other types of interview with critiques by the instructor.

311. **Statistical Methods in Psychology.** I. 3 hr. PR: Elementary statistics or consent. Basic concepts of statistical models, distribution, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, t , F , and X^2 distributions, completely randomized analysis of variance. (Equivalent to Stat. 311 and Educ. Psych. 311).
312. **Analysis of Variance.** II. 3 hr. PR: Psych. 311 or consent. Extension of basic concepts of statistical models, design of experiments, multiple classification models, factorial and split plot designs, simple covariance, orthogonal comparisons, and non-parametric statistics. (Equiv. to Stat. 312 and Educ. Psych. 312).
313. **Directed Study.** I, II, S. 1-3 hr. per sem. PR: Written consent. Directed reading and research in special areas. (Undergraduates should register for such projects under Psych. 213).
314. **Theory of Tests and Measurement.** I. 3 hr. PR: Elementary statistics or consent. Theory underlying psychological scaling, mathematical models, classical psychometrics. Includes introduction to concepts of reliability, validity, correlation and regression, multivariate analysis procedures.
315. **Multivariate Analysis.** I or II. 3 hr. PR: Psych. 311 or 314 or equiv. Correlational methods in psychology with application to typical research problems. Includes simple matrix algebra, multiple correlation, discriminant analysis, and an introduction to factor analysis. (Equivalent to Stat. 341).
318. **History of Psychology.** I or II. 3 hr. Traces the development of the science and concepts of psychology from their origin in philosophy, physiology, and medicine up to the modern era.
321. **Sensory Processes.** I or II. 3 hr. PR: Psych. 121 or 122 or equiv. Psychophysics of vision and audition are analyzed and related to current theories. Methods of research on sensory processes are reviewed.
322. **Conditioning and Learning.** I or II. 3 hr. PR: Psych. 122 and 121 or 123 or equiv. Review of current research in operant and classical conditioning. Controversial issues in learning are reviewed in light of recent research and theories.
323. **Perceptual and Cognitive Processes.** I or II. 3 hr. PR: Psych. 121 or 123 or equiv. Consideration of classical and contemporary research and theory on perception and cognitive processes, including concept formation and thinking.
324. **Motivation.** I or II. 3 hr. PR: Psych. 121 or 122 or equiv. Survey of experimental data and theory in the area of motivation as it relates to learning and personality.
331. **Physiological Psychology.** I or II. 3 hr. PR: Psych. 121, 122, and Biol. 266 or equiv. The biological bases for psychological activities such as perception, emotion, motivation and learning.
340. **Advanced Developmental Psychology.** I or II. 3 hr. PR: Psych. 141 and 314 or equiv. Research methods and substantive findings in the psychology of human development from birth to death, emphasizing developmental processes over the entire life-span.

347. **Comparative Psychology.** I or II. 3 hr. PR: Biol. 266 and Psych. 121 or 122. Comparison of the structure of representative animals of the various phyla in relation to differences in behavior.
351. **Advanced Social Psychology.** I or II. 3 hr. PR: Psych. 151 or consent. Consideration of contemporary theory and practice in social psychology.
352. **Group Dynamics.** I or II. 3 hr. PR: Psych. 151 or equiv. and consent. The psychological and sociological approaches to the dynamics of group processes. Includes discussion of leadership, informal communication and group processes, the relations of group aims to group organization, and the effects of the group on personality. (Equivalent to Sociol. 370).
355. **Behavioral Science and Health Care.** II. 3 hr. PR: Consent. Principles of behavioral science are applied to issues in physical and mental health care. Topics considered include the study of interpersonal roles and games, various cultural "healing" practices, personal and social aspects of illness, family disorganization, and hospitals and related institutions. (Equivalent to Behavioral Medicine and Psychiatry 355.)
363. **Personality Theory and Research.** I or II. 3 hr. PR: Psych. 263 and 314 or equiv. Intensive analysis of current research and theory in the psychology of personality.
379. **Professional Problems in the Practice of Psychology.** I or II. 2 hr. PR: Consent. Current problems in the practice of clinical psychology.
381. **Behavior Pathology.** I or II. 3 hr. PR: Psych. 263 and 281 and consent. Advanced study of etiology and dynamics of severe behavior pathology.
397. **Master's Thesis.** I and II. 1-6 hr.
409. **Seminar: Industrial.** I or II. 2 hr. PR: Consent. Current research and problems in industrial psychology.
416. **Factor Analysis.** I or II. 3 hr. PR: Psych. 315 or consent. Alternate methods for factor extraction, communalities, rotation in orthogonal and oblique space, and the estimation of factor scores. (Equivalent to Stat. 446).
418. **Theory Construction.** I or II. 3 hr. PR: Consent. Consideration of the methods of theory construction and the role of theory in selected areas of psychology.
419. **Seminar: Methodology.** I or II. 2 hr. per sem. PR: Consent. Current problems in statistics and research methods.
423. **Human Learning.** I or II. 3 hr. PR: Psych. 122 and 123 or equiv. Historical and contemporary review of research and theory in verbal learning, transfer, mediation, retention and memory processes, including motor skill learning and verbal conditioning.
429. **Seminar: Learning.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in the psychology of learning.
431. **Advanced Physiological Psychology.** I or II. 2 hr. PR: Psych. 331. Neuro-anatomical and neurophysiological correlates of complex behavior.
432. **Physiological Psychology Laboratory.** I or II. 2 hr. PR: Psych. 331 and consent. Research techniques used in exploring the neural basis of behavior.
439. **Seminar: Physiological.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in physiological psychology.

441. **Developmental Psychophysiology.** I or II. 3 hr. PR: Psych. 331, 340 and consent. Review of current research and problems investigating the developmental relationship between physiological response systems and psychological processes through the human life span.
442. **Developmental Cognition and Language.** I or II. 3 hr. PR: Psych. 340 and consent. Cognitive change, language acquisition and use throughout the human life span. Interplay of language with conceptual organization and mediating processes.
444. **Socialization.** I or II. 3 hr. PR: Psych. 340 and consent. A review of the current state on theory and research in the field of life-span socialization with an emphasis on the consideration of age-related changes in the agents, mechanisms, goals and products inherent in organism-environment interaction.
446. **Developmental Perception.** I or II. 3 hr. PR: Psych. 340 and consent. A review of research investigating the relationship between maturational and perceptual processes through the life-span. Selected topics will include development of attention, perceptual organization, mechanisms of perceptual development, and the influence of age on sensory processing.
447. **Developmental Learning Processes.** I or II. 3 hr. PR: Psych. 340 and consent. A systematic review of research and theory related to the interaction of learning and maturational processes in children, retardates and adults. Selected topics covered include concept formation, discrimination learning, learning set, conditioning, verbal and language behavior, and other topics of contemporary interest.
448. **Advanced Personality Development.** I. 3 hr. PR: Psych. 340, 363 and consent. Review and examination of current research and theory in personality development through the human life span.
449. **Seminar: Developmental.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in developmental psychology.
459. **Seminar: Social.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in social psychology.
469. **Seminar: Personality and Abilities.** I or II. 2 hr. per sem. Current research and problems in the areas of personality and trait measurement.

NOTE: All courses in the 470 series are professional skills courses open only to degree candidates in Psychology except by special departmental permission.

470. **Objective Methods of Personality Assessment.** I. 3 hr. PR: Consent. Observation, science and psychological assessment; the development of psychological tests; behavioral rating scales; behavioral assessment; the interview as an assessment instrument.
471. **Individual Intelligence Testing.** II. 3 hr. PR: Psych. 470 and consent. Intelligence testing, performance and non-language tests, assessment of central nervous system impairment, assessment of children and geriatric patients.
472. **Projective Personality Assessment Techniques.** (Not offered in 1972-73) PR: Psych. 470 and consent. Administration, scoring and interpretation of techniques for the assessment of private experience.
473. **Advanced Personality Assessment.** I or II. PR: Psych. 471 and consent. Supervised practice in the diagnostic application of personality assessment techniques. Includes clerkship in various mental health facilities.

- 474, 475. **Behavior Modification.** I, II. 3 hr. per sem. PR: Psych. 322 and consent. Theory and practice of behavior modification based on learning theory and dynamic personality theory problems.
476. **Group Methods of Behavior Modification.** I or II. 3 hr. PR: Psych. 352 and consent. Application of principles of group dynamics, personality and learning theory to the use of group processes for the modification of abnormal behavior patterns.
477. **Clinical Psychology Practicum.** I and II. 1-6 hr. per sem. PR: Psych. 471 and consent. Supervised practice of psychological techniques in clinics or institutional settings. Includes experience in psychological testing, interviewing, report writing, case presentation, interpretation of tests and supportive counseling. Primarily for students in the professional master's program in clinical psychology.
478. **Advanced Clinical Practicum.** I and II. 1-6 hr. per sem. PR: Psych. 474, 475, and consent.
479. **Seminar: Clinical.** I or II. 2 hr. per sem. PR: Consent. Current research and problems in clinical psychology.
489. **Seminar: Abnormal.** I or II. 2 hr. per sem. Current research and problems in abnormal psychology.
490. **Teaching Practicum.** I and II. 1-3 hr. PR: Consent. Supervised practice in the college teaching of psychology.
497. **Research.** I and II. 1-15 hr.

RELIGIOUS STUDIES

290. **Seminar: Selected Topic.** I or II. 3 hr. PR: A previous Religious Studies course or consent.
291. **Seminar: Selected Topic.** I or II. 3 hr. PR: A previous Religious Studies course or consent.

SOCIOLOGY

Candidates for the Master's Degree in Sociology must have an adequate undergraduate preparation in sociology or make up the deficit by taking courses which will not be credited toward the graduate degree. The latter may mean an additional semester or summer term of study. If not taken for undergraduate credit, Sociology 201 and 211 (or equivalents), and a course in Statistics must be included in the program. Master's candidates are expected to earn 12 hours of seminar credit. A thesis is required of all candidates in addition to a total of 30 hours of course work (reduced to 24 should the student have an especially strong background in Sociology). The candidate must pass a final examination, which may be oral, written, or both, at the discretion of the department. A part of this examination will test the candidate's general comprehension of the field of Sociology.

Current information regarding admission, either as a regular or special student, can be obtained by writing the Chairman, Department of Sociology.

Sociology

Sociol.

Sociology 1, or equivalent, or Sociology 101, is prerequisite for all courses in the Sociology 200 series.

201. **Types of Sociological Theory.** I, II. 3 hr. Examination of leading schools of sociological thought both historical and contemporary.
203. **Collective Behavior.** I or II. 3 hr. Analysis of new group formation and behavior following social dislocation, social unrest, crowd behavior, and other forms of social contagion; the public and public opinion; social movements.
204. **Complex Organizations.** I or II. 3 hr. A sociological analysis of large-scale organizations, emphasizing their structure and functions. The course will examine the place in contemporary society of such organizations as the military, prisons, and hospitals.
205. **Social Stratification.** I, II. 3 hr. Description and analysis of various types of stratification systems, such as class and caste; social mobility and status-striving. The course emphasizes the place of status, prestige, and power in the structure of American society.
211. **Introduction to Social Research.** I, II. 3 hr. Trends in social research; examination of methods and techniques.
221. **Sociology of Childhood.** I, II. 3 hr. Adjustment of child to American culture.
222. **Principles of Community Development.** I. 3 hr. PR: Sociol. 1 or 101, or equiv., or consent. An applied course dealing with the principles and techniques of community organization and development.
223. **Sociology of Rural Life.** I or II. 3 hr. Social aspects of rural living. Characteristics of rural population, social structure, and institutional arrangements: family, community, education, religion, recreation, health, welfare, and local government.
231. **Society and Health.** I. 3 hr. The study of medicine as a complex form of social organization and of illness-related behavior. Although primary focus is upon analysis of contemporary North American health systems, interest also centers on historical and cross-cultural analysis.
232. **Sociology of Education.** I, II. 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community.
233. **Industrial Sociology.** I or II. 3 hr. The sociology of industrial relations. The factory or business firm as a social system. Formal and informal relations within the plant.
240. **Social Change.** I or II. 3 hr. Sociological analysis of the major changes now going on in our society, of the forces underlying them, and of the tensions to which they give rise. Alternative future directions; rational manipulation and planning for social change.
241. **Population and Migrations.** I or II. 3 hr. Population theories; growth, composition, and distribution of American population; immigration and culture pluralism; internal migrations and their consequences.
251. **Cultural Dynamics.** I. 3 hr. The nature of culture and culture change. Historical trends in the study of cultural dynamics: focal interests, doctrines, and methods of study.

252. **Culture and Personality.** I, II. 3 hr. Significant interrelations between the individual and his culture.
253. **Cross-Cultural Studies in Development.** I or II. 3 hr. Comparative study of the processes of change in societies in the early stages of industrialization.
260. **Society and Personality.** I, II. 3 hr. Deals with how selves are modified through interaction with others. Emphasizes theories of identity and introduces experimental design.
290. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. (May be repeated for a max. of 9 hr.). Tutorial or seminar for selected strongly qualified students.
291. **Seminar.** I, II. 3 hr. PR: Consent. Primarily for sociology majors. Principles of sociology are emphasized.

Prerequisite for all courses in the "300" and "400" series: Consent of chairman of graduate program committee.

370. **Group Dynamics** (Same as Psych. 352.). I. 3 hr. An interdepartmental course, combining psychological and sociological approaches, in which the dynamics of groups in operation are considered.
390. **Seminar.** 3-9 hr.
391. **Seminar.** 3-9 hr.
393. **Tutorial.** 3-9 hr.
394. **Thesis.** I, II. 1-6 hr.
497. **Research.** 1-15 hr.

SPEECH

The Degree of Master of Arts

The Department of Speech offers work leading to the Master of Arts degree in General Speech, Rhetoric and Public Address, and Radio, Television, and Film. Persons who possess a bachelor's degree from an accredited college or university may be admitted to the program. Although normally the entering graduate student has an undergraduate major in speech, qualified students from related areas are admitted with the understanding that any deficiencies in undergraduate preparation must be made up without credit toward the Master of Arts degree, or added to the credit requirements for the degree.

In addition to the general requirements of the Graduate School, the graduate student in speech must meet the following departmental requirements:

- I. Successful completion of the minimum number of required graduate hours as set forth in Program A or Program B below.
- II. Completion of Speech 401 and at least one Seminar in speech.

- III. Successful completion of three 3-hour written comprehensive examinations.
- A. Comprehensive examinations draw upon broad course concepts as applied to theoretical and practical problems in communication.
 - B. A "B" average is prerequisite to the writing of such examinations.
 - C. No student shall be considered a candidate for the Master of Arts degree in speech, nor permitted to take the final oral examination, until he has passed the comprehensive examinations.

Program A—The Thesis Program

1. At least 30 hours of graduate credit, 21 of which must be in the curriculum of the Department of Speech.
 - a. A maximum of 6 hours of research and thesis may be included in the 21 hours.
 - b. Problem topics in Speech 475 (Independent Study), and Speech 497 (Research), may not be expanded into a thesis.
2. Pursuit of courses in cognate fields upon the advice and approval of the Department Graduate Committee.
3. A thesis.
4. An oral examination.

Program B—The Non-Thesis Program

1. A minimum of 36 semester hours of graduate credit, 24 of which must be in the curriculum of the Department of Speech.
2. Students emphasizing Rhetoric and Public Address or General Speech: Satisfactory completion of an oral examination relating to speech theory, principles, methodology, and philosophy.
3. Students emphasizing Radio, Television, or Film: Satisfactory completion of an oral examination relating to the philosophy, methods, and concepts within the area of specialization.

Speech

221. **Persuasion.** I, S. 3 hr. PR: Speech 11 or 34 and consent. Study and practice in the identification of factors motivating human behavior and belief, how to secure and hold attention, the uses of suggestion, the dramatization of ideas.
273. **Speech for the Teacher.** II. 3 hr. PR: Consent. History, philosophy, literature and current practices in curricular and extra-curricular speech programs. Planned to serve the needs of the teacher of speech and language arts.
275. **Speech Problems of Children.** II, S. 3 hr. PR: Consent. Normal maturational development of listening and speaking skills, their relationships to language acquisition, and their influences upon achievement. Primarily for elementary and secondary school teachers and language arts supervisors.

280. **Radio and Television Dramatic Writing.** II. 3 hr. PR: Speech/Journalism 80, and Speech 184, or consent. Theory and practice of broadcast dramatic script writing. Experience in writing adaptations, original comedy, and tragedy, as well as serial dramas, and documentaries for commercial and educational broadcasting and film purposes. Scripts written for definite markets.
282. **Radio Workshop.** I. 3 hr. PR: Speech 184 and Speech 185 or consent. Advanced laboratory experience in the theory, art, and craftsmanship of radio production, involving the producing of University radio programs. Adapted to student interest in both commercial and educational or public broadcasting.
283. **Television Workshop.** I. 3 hr. PR: Speech 185 and Speech 184 or consent. Advanced laboratory experience in the theory, art, and craftsmanship of television production, involving the producing of University television programs. Adapted to student interest in both commercial and educational or public broadcasting.
284. **Radio and Television Program Planning.** II. 3 hr. PR: Speech 80 and consent. Analysis of the purpose and program idea in relation to audience composition. Requirements of effective structure. Practice in laying out various program formats for radio and television. Attention also given to program promotion.
289. **Documentary Film Production.** II. 3 hr. PR: Speech/Journalism 189 and Speech 184 or Speech 280. A detailed study of the documentary as a film form and social commentary. Class will be divided into film units which will complete the production of a documentary film using professional equipment. It may be necessary for students to pay for camera rental, film stock and film processing.
320. **Speech Composition.** I or II. 3 hr. PR: Speech 11 or 34 and consent. Emphasis on composing the speech for purposes of oral discourse. Consideration given to oral language, word choice, rhetorical structure and style. Study and critical analysis of selected speeches.
322. **Forms of Public Address.** II, S. 3 hr. PR: Speech 11 or 34 and consent. Combines the study of the essential principles of effective speaking with the application of those principles to specific speech occasions. The critical analysis and evaluation of forensic, deliberative, and epideictic speeches.
323. **Advanced Group Discussion.** II, S. 3 hr. PR: Speech 120 or consent. Application of the principles and practices of the dynamics of groups to classroom teaching, conference and committee work, policy-determining groups and the public forum.
325. **Directing the Forensic Program.** II or S. 3 hr. PR: Consent. Study of the principles and techniques of administering a forensic program, tournament direction, and conducting extracurricular activities.
330. **Classical Rhetoric.** I. 3 hr. PR: Consent. A survey of the rhetoric of the classical period with special attention given to Greek and Roman rhetors, from Plato to Quintilian.
335. **American Public Address to 1860.** I. 3 hr. PR: Consent. Critical study of leading American speakers of the Colonial period through the Early National period, their biographies, speeches, and issues with which they dealt.
336. **American Public Address Since 1860.** II. 3 hr. PR: Consent. A critical study of leading American speakers, their speeches, and the issues with which they dealt, from the Later National Period to 1960.

370. **Psychology of Speech.** II. 3 hr. PR: Consent. Modern psychological principles of speech learning and usage. Influences of emotion, conditioning, and habit formation on listening, thinking, language, and personality as factors in oral communication.
389. **Film Directing and Cinematography.** I or S. 3 hr. PR: Speech 289. An advanced study of motion picture production from the directional and cinematographic standpoint. Students will undertake individual film projects which will explore the possibilities of the film medium as an expressive art form. The class will produce a short 35 mm film. It may be necessary for students to pay for camera rental, film stock and film processing.
401. **Introduction to Graduate Study in Speech.** I or S. 3 hr. Major emphasis is placed upon the principles of historical, descriptive, and experimental research methods used in speech, broadcasting, and film. The course should be taken at the beginning of the graduate program.
433. **Special Topics.** I, II, S. 3-12 hr. (Limited to 3 hr. per sem.). PR: Consent. Thorough study of a special topic in speech, including British public address, protest rhetoric, rhetorical criticism, communication theory, and semantics.
475. **Independent Study.** I, II, S. 1-3 hr. PR: Speech 401, a speech seminar, or consent of chairman of department. Open to graduate students in speech who are pursuing independent problems in that field.
496. **Seminar in Communications.** I, II, S. 3-9 hr. (Limited to 3 hr. per sem.). An examination of current problems and research in Rhetoric and Public Address, Radio-Television-Film, or General Speech.
497. **Research.** I, II, S. 1-15 hr.
499. **Thesis.** I, II, S. 2-4 hr.

STATISTICS AND COMPUTER SCIENCE

The Department of Statistics and Computer Science offers a Master of Science degree with a major in Statistics. The Master of Science degree is intended to qualify the student to:

1. Assume a professional role in an educational, industrial, or governmental research project,
2. Teach the subject matter of his major in a junior or senior college, or
3. Undertake advanced training toward a doctorate in one of the quantitative fields of science.

To obtain the Master of Science degree in Statistics a minimum of 36 hours of graduate coursework is required. Because, however, many students receive baccalaureate degrees from colleges which do not offer undergraduate programs in either statistics or computer science, they may lack certain prerequisite courses. Those lacking prerequisite courses may find it necessary to take coursework in addition to the required 36 hours; such additional work may include lower division courses for which graduate credit cannot be given.

Major in Statistics

A minimum of 18 hours in statistical methods, applications, and theory are required. Additional graduate level courses will consist of elective courses in statistics or computer science, supporting mathematics courses, or approved courses in a specific field to which the candidate may wish to apply his statistical knowledge.

A problem report is also required. As much as 3 hours credit in research can be given for the report and applied toward the supporting coursework.

Statistics

Stat.

201. **Intermediate Statistical Methods.** II. 3 hr. PR: Stat. 101. Extension of basic concepts of statistical models, elementary decision theory, estimation, random variables, one- and two-way classification models, analysis of variance, F-distribution, time series, seasonal and cyclical movements, simple and multiple linear regression and correlation analysis (equiv. to Econ. 226).
213. **Basic Statistical Analysis 1.** I, II. 3 hr. PR: Math. 16. Measures of central tendency and variation, probability, sampling, probability distributions, inference, tests of hypotheses, confidence intervals, analysis of variance, simple linear regression and correlation, and enumeration statistics (equiv. to I.E. 213).
214. **Basic Statistical Analysis 2.** I, II. 3 hr. PR: Stat. 213 or equiv. Single and multi-factor experimental designs; fixed, mixed and random effect models; split plot designs; multilinear and nonlinear regression and correlation and analyses; and analysis of covariance (equiv. to I.E. 214).
215. **Statistical Computer Techniques.** II. 2 hr. PR: Math. 121 or I.E. 181 and pre- or corequisite Stat. 201, or consent. Extension of concepts and skills related to using digital computers for statistical analysis. In addition to programming statistical analyses and elementary simulations in the Fortran language, programs available in the Computer Center Statistical Program Library will be utilized.
231. **Sampling Methods.** I. 3 hr. PR: An introductory course in statistics. Methods of sampling from finite and infinite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single and multi-stage sampling procedures.
261. **Statistics and Probability 1.** I. 3 hr. PR: Math. 16. Probability, discrete and continuous probability distributions, expectations, sums of random variables, sampling distributions, point and interval estimation, tests of hypotheses.
262. **Statistics and Probability 2.** II. 3 hr. PR: Stat. 261. Statistical inference and decision theory; properties of hypotheses; bivariate and multivariate distributions; least squares procedures.
291. **Special Topics.** I, II, S. 1-6 hr. Advanced study of special topics in statistics.

311. **Statistical Methods 1.** I, II. 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence intervals, regression, correlation, transformations, F and χ^2 distributions, analysis of variance of one- and two-way classification models, multiple range tests, missing plots, and sample size (equiv. to Psych. 311; and Ed. Psych. 311).
312. **Statistical Methods 2.** I, II. 3 hr. PR: Stat. 201, Stat. 213, or Stat. 311. Extension of basic concepts of statistical models, design of experiments, multiway classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlation analysis, chi-square, and non-parametric statistics (equiv. to Psych. 312 and Ed. Psych. 312).
321. **Design of Experiments.** I. 3 hr. PR: Stat. 214 or Stat. 312. Extension of basic concepts of statistics to the more complicated models and use of samples, design and analysis of experiments over time and space, fractional replications, incomplete block design, cross-over designs, lattice designs, and least square analysis for designs with unequal subclass numbers.
333. **Nonparametric Statistics.** II. 3 hr. PR: An introductory course in statistics. Single sample tests; for related samples, two independent samples, k related samples, k independent samples, and measures of correlation.
341. **Multivariate Statistics 1.** I. 3 hr. PR: Stat. 201, Stat. 213, or Stat. 311. Introduction to elementary matrix operations, partial and multiple linear and nonlinear correlation and regression analyses, and introduction to discriminant analysis (equiv. to Psych. 315).
342. **Multivariate Statistics 2.** II. 3 hr. PR: Stat. 341 or equiv. This course includes a discussion of the multivariate normal distribution, tests of hypotheses about the sample mean vectors and variance-covariance matrices from a multivariate normal distribution, and analysis of variance of multiple responses in basic statistical designs.
361. **Theory of Statistics 1.** I. 3 hr. PR: Math. 51. Probability and random variables, univariate and multivariate probability distributions, expectations, moments, marginal and conditional distributions, independence, correlation, transformations, and functions of random variables.
362. **Theory of Statistics 2.** II. 3 hr. PR: Stat. 361. Estimation including bias, consistency, efficiency and sufficiency, hypothesis testing, distribution-free problems, order statistics, linear models and analysis of variance and special distributions.
446. **Factor Analysis.** II. 3 hr. PR: Stat. 341. Alternative methods for factor extraction, communalities, rotation in orthogonal and oblique space, and estimation of factors scores (equiv. to Psych. 416).
451. **Linear Statistical Models 1.** I. 3 hr. PR: Stat. 312 or equiv. and Stat. 362 or consent. Statistical concepts, multivariate normal distribution, distribution of quadratic forms, linear models, general linear hypotheses, polynomial models, functional relationships and regression models.
452. **Linear Statistical Models 2.** II. 3 hr. PR: Stat. 451. Experimental design models, factorial models, incomplete block models, assumptions of experimental design models, and components of variance for fixed, random, and mixed models.

Computer Science

C.S.

- 212. **Data Structures. II.** 3 hr. PR: C.S. 101 and 112 or consent. Basic concepts of data. Structures of storage media and machines. Methods of representing structured data in storage and techniques for operating on it.
- 220. **Numerical Analysis 1. I.** 3 hr. PR: Math. 17 and C.S. 120 or consent. Solutions of equations, interpolation and approximations. Numerical differentiation and intergration. Numerical solution of initial value problems in ordinary differential equations. (Equiv. to Math. 220).
- 221. **Numerical Analysis 2. II.** 3 hr. PR: Math. 17 and C.S. 120 or consent. Solutions of linear systems by direct and iterative methods. Matrix inversion, evaluation of determinants, and calculation of eigenvalues and eigenvectors of matrices. Application to boundary value problems in ordinary differential equations. (Equiv. to Math. 221).
- 224. **Digital Simulation. I.** 3 hr. PR: C.S. 101 and Stat. 201 or consent. Introduction to simulation and comparison with other techniques. Generation of random numbers and variates, design of simulation experiments. Validation of simulation models and results.
- 230. **Programming Languages. I.** 3 hr. PR: C.S. 101 and 112 or consent. Formal definition of programming languages including specification of syntax and semantics. Structure of simple statements and algorithmic languages. List processing and string manipulation languages.
- 240. **Systems Programming. I.** 3 hr. PR: C.S. 212 and 230 or consent. Software organization for the support of computer components. Addressing techniques, process and data modules, file system organization and management. Traffic control and communication with peripheral devices.
- 291. **Special Topics. I, II, S.** 1-6 hr. PR: Consent. Advanced study of special topics in computer science.
- 301. **Computers in Research 1. I, S.** 3 hr. The use of computers in research. Organization and characteristics of computers. Algorithms, machine language programming, scientific oriented language programming subprograms, program segmentation, and linkage.
- 302. **Computers in Research 2. II.** 3 hr. PR: C.S. 301. Data retrieval, scientific and business data processing, survey methods. Simulation and simulation languages. Formal definition of programming languages.
- 330. **Design of Language Processors. II.** 3 hr. PR: C.S. 230. Study of the design and construction of automatic programming language processors. Investigation of the structure of scientific and business oriented compilers, list processors, and information processing languages.
- 340. **Design of Programming Systems. II.** 3 hr. PR: C.S. 240. Design of monitor systems, executive systems and operating systems for high speed digital computers. Emphasis placed on current generation computers with multiprogramming, interactive, teleprocessing, and real time capabilities.
- 390. **Advanced Study in Computer Science. I, II, S.** 1-6 hr. PR: Consent. Investigation in advanced computer science subjects which are not covered in regularly scheduled courses. Study may be independent or through specially scheduled lectures.
- 391. **Research in Computer Science. I, II, S.** 1-15 hr.

College of Business and Economics

The College of Business and Economics offers graduate programs in business administration, economics, and industrial relations.

The program in business leads to the degree of Master of Business Administration (M.B.A.). This program is supervised by the Graduate Faculty in Business Administration and the students in business are administered by the Director of Graduate Programs in Business.

Graduate programs in economics lead to the degrees of Master of Arts (M.A.) and Doctor of Philosophy (Ph.D). These programs are supervised by the Graduate Faculty in Economics and students in them are administered by the Director of Graduate Programs in Economics.

The program in industrial relations leads to the degree of Master of Science. This program is supervised by the Graduate Faculty in Business and Economics and the students are administered by the Director of Graduate Programs in Industrial Relations.

All work for a graduate degree must be completed within a period of seven years. An extension of this period must be approved in writing by the appropriate graduate faculty and the Dean of the Graduate School.

GRADUATE PROGRAM IN BUSINESS ADMINISTRATION

To receive approval to enter the M.B.A. program an applicant must have a baccalaureate degree from an accredited college or university with an undergraduate average of at least 2.5 (of a possible 4.00). Applicants with a baccalaureate degree, an undergraduate grade-point average of at least 2.25 but less than 2.5, and an acceptable score on the Admissions Test for Graduate Study in Business may be approved to enter the program on a probationary basis. To assure that all students in the program have the same foundation in business, the applicant must have completed the following courses or their equivalent:

- Principles of Accounting (2 semesters)
- Principles of Economics (2 semesters)
- Principles of Marketing
- Principles of Management (or Industrial Management)
- Business Finance
- Principles of Statistics

A student without the necessary prerequisite courses may be approved to enter the M.B.A. program on probation subject to removal of any deficiencies prior to his taking the required graduate courses. Scores on the Admission Test for Graduate Study in Business must be submitted before an applicant can be considered for the M.B.A. program. All applicants for approval to enter the M.B.A. program must be received in the WVU Admissions and Records Office at least one month prior to the date for which enrollment is requested.

Master of Business Administration (M.B.A.)

The candidate's program of courses will be planned with the assistance of a faculty adviser and must have his approval. The M.B.A. degree requires a total of 36 hours of graduate credit, including the following courses:

Fall Semester*

- Accounting 301—Managerial Control, 3 hr.
- Economics 301—Managerial Economics, 3 hr.
- Economics 302—Research and Reports, 1 hr.
- Management 301—Administrative Practices, 3 hr.
- Management 302—Quantitative Business Analysis, 3 hr.

Spring Semester**

- Economics 302—Research and Reports, 2 hr.
- Finance 313—Financial Administration, 3 hr.
- Management 313—Production Administration, 3 hr.
- Marketing 313—Marketing Administration, 3 hr.

Summer Session

- Management 323—Administrative Policy, 3 hr.***

*PR: The undergraduate courses listed above, or consent

**PR: The required courses offered in the fall semester, or consent

***PR: The required courses offered in both the fall and spring semester, or consent

The candidate will also complete 9 semester hours of elective courses selected with the approval of his adviser. Of these electives, at least 3 hours must be in a graduate course of the College of Business and Economics at the "300" level, preferably in a graduate seminar in business. No thesis is required, but writing is emphasized in all courses.

The M.B.A. program requires that the student maintain a grade-point average of at least 3.0 (B) on all work taken as a graduate student while enrolled in the College, including pre-

scribed work taken to remove undergraduate deficiencies. A student whose cumulative grade-point average falls below 2.75 will be placed on probation. If his average is not brought up to 2.75 by the end of the following semester, he will be suspended from this program. A grade below "C" in any course taken while enrolled as a graduate student will result in suspension from this graduate program. In addition, the student must maintain a 3.0 (B) average in all work counting toward the graduate degree.

GRADUATE PROGRAM IN ECONOMICS

All applicants must take both the general aptitude test and the economics advanced test of the Graduate Record Examination. Prior to admission to the program, students are required to have completed at least 18 semester hours of course work in economics. Six of these hours may be in principles of economics, at least 3 hours must be in statistics, and not more than 3 hours may be from the functional fields of accounting, finance, marketing, management, etc. A minimum grade of "C" is required in each of the courses taken to meet the 18 hour economics requirement. Applicants must have a 2.5 grade-point average or better ($A=4.0$) for all undergraduate work completed.

Students who do not meet these entrance requirements may be admitted on probation subject to the correction of the deficiencies at the beginning of the program. Deficiencies in undergraduate preparation must be removed without graduate credit. No student will be admitted on probation unless his grade-point average is at least 2.0.

To qualify for the masters degree, graduate students in economics must earn a cumulative grade-point average of 2.75 in all courses attempted during their tenure as graduate students at West Virginia University. To qualify for the Ph.D. degree, graduate students in economics must earn a cumulative grade-point average of 3.0 (B). A student whose cumulative grade-point average falls below 2.5 will be placed on probation. If his average is not brought up to 2.5 by the end of the following semester, he will be suspended.

Master of Arts (M.A.)

The candidate's program of courses will be planned with the assistance of the faculty adviser and must have his approval. The M.A. degree requires a total of 30 semester hours of graduate credit, including:

- (1) Economics 310—Advanced Micro Theory I. 3 hr.
Economics 312—Advanced Macro Theory I. 3 hr.
- (2) Economics 316—History of Economic Doctrines and Analysis. 3 hr.
If the student has successfully completed Economics 216—History of

Economic Thought or its equivalent prior to entering the graduate program, any 300 level economics course may be substituted.

- (3) An additional 6 semester hours of 300 level courses and 3 semester hours of either 200 or 300 level economics courses. No more than 6 semester hours of the electives, both 200 or 300 level, stipulated under (2) and (3) may be taken in the same field of specialization.
- (4) a. An acceptable thesis, 6 hr. b. The following may be substituted for a thesis in meeting the requirements for the M.A. degree in economics: (a) completion of 6 additional semester hours subject to approval by the Graduate Director; (b) a written comprehensive examination; and (c) a research paper that gives evidence of substantial ability to conduct scholarly research.

Students must also pass a qualifying examination in statistics and quantitative methods. A minimum grade of "C" in Advanced Statistics (Econ. 226 or its equivalent) and Introduction to Quantitative Analysis (Econ. 220) may be substituted in lieu of these qualifying examinations.

Doctor of Philosophy (Ph.D.)

At least three years of full-time graduate work beyond the baccalaureate degree are usually required to qualify for the doctorate. Two of the three years of residence must be at West Virginia University, including at least two consecutive semesters in actual residence as a full-time graduate student.

The Ph.D. degree is not awarded for the mere accumulation of course credits nor for the completion of the specified residence requirements. A minimum, however, of 36 hours of graduate work in economics at the 300 level is required for all candidates for the Ph.D. degree in economics. These must include 18 hours in the graduate core curriculum in economics which includes:

Economics

- 310—Advanced Micro Theory I. 3 hr.
- 311—Advanced Micro Theory II. 3 hr.
- 312—Advanced Macro Theory I. 3 hr.
- 313—Advanced Macro Theory II. 3 hr.
- 316—History of Economic Doctrines and Analysis. 3 hr.
- 320—Quantitative Analysis. 3 hr.

Six additional hours must be taken at the 300 level in each of the candidate's fields of concentration other than Economic Theory. The remaining hours will be selected by the student with the aid of his adviser.

For admission to candidacy for the Ph.D. Degree the student must:

1. Satisfy the foreign language requirement of the Graduate School.

2. Demonstrate proficiency in statistical technique by successful completion of a qualifying examination or, alternatively, by achieving a minimum grade of "B" in Advanced Statistics (Econ. 226 or equivalent courses.)

3. Successfully complete preliminary examinations in four fields which include economic theory (Micro Theory, Macro Theory, and History of Economic Doctrines), two other fields of concentration in economics and one other field in economics or in an outside area. The selection of an outside field must be done with the advice and consent of the student's graduate committee.

When an applicant has successfully passed his qualifying examinations, he will be formally promoted to candidacy for the doctoral degree by at least one academic year.

The candidate must submit a thesis pursued under the direction of the Graduate Faculty in Economics on some problem in the area of the candidate's major interest. The thesis must present the results of the candidate's individual investigation and must embody a definite contribution to knowledge. It must be approved by a committee of the Graduate Faculty in Economics. An oral examination on the thesis is required.

After approval of the candidate's thesis and satisfactory completion of other graduate requirements, he shall have a final examination by his advisory committee. See the general regulations for graduate degree beginning on page 26 for further information on the dissertation, residence requirements, final examination, request for degree, and attendance at commencement.

GRADUATE PROGRAM IN INDUSTRIAL RELATIONS

Applicants for admission must have a baccalaureate degree from an accredited university or college with a minimum of 21 hours of undergraduate work in the social sciences, including at least 3 hours in statistics and 3 hours in labor economics. The social sciences are interpreted to include economics, history, political science, psychology, sociology, and general social science. In addition to the course requirements, applicants must have a 2.5 (based on 4.0) grade-point average in undergraduate work. Applicants with a baccalaureate degree and an undergraduate grade-point average of at least 2.25 but less than 2.5 may be approved to enter the program on a probationary basis. Students who do not have the necessary undergraduate courses may be admitted as probationary students, but undergraduate deficiencies must be removed in the first semester of residency without graduate credit. Scores on the general aptitude test of the Graduate Record Examination must be submitted by all applicants for the program.

To receive the master of science degree, the candidate may select either a thesis or a non-thesis program. The non-thesis

program requires 36 hours of graduate work which will include the following 18 hours of required courses:

Economics 262—Collective Bargaining or
 Economics 261—Trade Unionism. 3 hr.
 Psychology 201—Personnel Psychology. 3 hr.
 Sociology 223—Industrial Sociology. 3 hr.
 Statistics 311—3 hr.
 Industrial Relations 430—Seminar in Industrial Relations. 6 hr.

The remaining hours will be chosen from the following courses after consultation with the adviser. While the listed courses are preferred, considerable latitude may be given the student by his adviser to choose other courses which are particularly appropriate to his background and interest. Approval must be obtained in advance.

Industrial Engineering	Hr.	Economics	Hr.
220—Theo. Ind. Eng'g. & Org.	3	211—Micro. Econ. Anal.....	3
222—Job Eval. & Wage Incent.....	2	212—Macro. Econ. Anal.	3
		263—Economics of Wages	3
		360—Adv. Labor Econ.	3
Psychology		364—Seminar, Labor Econ.	3
304—Leadership and Human Rel.	3	390—Readings in Econ.	1-3
307—Prac. Indust. Interview	3		
313—Directed Studies.....	1-3	Law	
		264—Labor Law	3
Management		Sociology	
216—Personnel Management.....	3	203—Collective Behavior.....	3
225—Business Policy	3	204—Complex Organizations	3
		Rehabilitation Counseling	
Political Science		320—Vocational Development & Occupational Choices.....	3
341—Adm. Org. and Man	3		
440-441—Dir. Read. in Pub. Adm.	2-4		

The thesis program requires 30 hours of graduate work which will include the 18 hours of required courses, 6 hours of Industrial Relations 497—Thesis, and 6 hours of approved electives. An average of 3.0 must be maintained in courses taken prior to the thesis.

The industrial relations program requires that the student maintain a grade-point average of at least 3.0 (B) on all work taken as a graduate student while enrolled in the College, including prescribed work taken to remove undergraduate deficiencies. A student whose cumulative grade-point average falls below 2.75 will be placed on probation. If his average is not brought up to 2.75 by the end of the following semester, he will be suspended from the program. A grade below "C" in any course taken while enrolled as a graduate student will result in suspension from this graduate program. In addition, the student must maintain a 3.0 (B) average in all work counting toward the graduate degree.

Accounting

- 200. **Special Topics.** I, II, S. 1-4 hr. PR: Accounting 112 or consent. Study of special topics relevant to accounting. Maximum of 9 semester hours in any or all courses numbered 200 offered by this college may be applied toward the bachelor's and master's degrees.
- 211. **Accounting Systems.** I. 3 hr. PR: Accounting 112. The adaptation of accounting procedures to the demands of the firm, with emphasis on theoretical factors important to efficiency and internal control; system surveys and reports, the design of forms, office machine applications.
- 213. **Income Tax Accounting.** I. 3 hr. PR: Accounting 112 or consent. Tax theory and practice as developed from the regulations of the Internal Revenue Service; problems in preparation of tax returns for individuals, partnerships, and corporations.
- 214. **Income Tax Accounting.** II. 3 hr. PR: Accounting 213. A continuation of Accounting 213.
- 216. **Advanced Cost Accounting.** II. 3 hr. PR: Accounting 115. Advanced work in the application of cost theory and procedures to cases and problems which emphasize the managerial use of cost information.
- 217. **Auditing Theory.** I or II. 3 hr. PR: Accounting 112. Auditing fundamentals; objective standards and procedures; introduction to working-paper techniques; procedure statements of the American Institute of CPAs.
- 218. **Auditing Practice.** I or II. 3 hr. PR: Accounting 217. Application of auditing theory and procedures, with emphasis on decisions which invoke judgment and are important in independent audits; audit working papers and reports; case studies.
- 224. **Advanced Accounting Problems.** I or II. 3 hr. PR: Minimum of 18 hours in accounting with an average grade of "B" or higher. Analysis and solution of representative CPA problems.
- 230. **Advanced Accounting Theory.** I or II. 3 hr. PR: Accounting 112, 115, and consent. Critical analysis of accounting concepts and standards with emphasis on their origin, development, and significance.
- 301. **Managerial Control.** I. 3 hr. PR: Accounting 52 and Econ. 125. The use and significance of the quantitative techniques of accounting, statistics, and budgeting for planning, control, and decision making.
- 329. **Seminar in Accounting.** I or II. 3 hr.
- 497. **Research.** I, II. 1-15 hr.

Economics

Specialized Courses

- 200. **Special Topics.** I, II, S. 1-4 hr. PR: Econ. 51 and 52 or consent. Study of special topics relevant to economics. Maximum of 9 semester hours in any or all courses numbered 200 offered by this college may be applied toward the bachelor's and master's degrees.
- 205. **Current Economic Problems.** S. 3 hr. PR: Econ. 51 and 52 or consent. For students in Education only. A course designed to acquaint public school teachers with reliable source material in economics and to instruct them in studying current economic problems.

265. **Economics of Social Security.** I or II. 3 hr. PR: Econ. 51 and 52 or consent. An examination and analysis of our social and political efforts to provide economic security, including an examination of the parallel developments of private insurance.
301. **Managerial Economics.** II. 3 hr. For students in the M.B.A. Program. An analysis of markets and the problems of management in appraising business conditions and in adjusting to changes in product demand, costs, level of output, and profits.
302. **Research and Reports.** I, II. 1-3 hr. For students in the M.B.A. Program. A study of sources of business information and research procedures, with application in the preparation of reports.

Economic Theory

210. **Comparative Economic Systems.** I or II. 3 hr. Structure and processes of existing economic systems throughout the world including review of basic principles of free enterprise, socialistic, communistic, and fascistic societies. Comprehensive analysis based on current and recent experiments in these economies.
211. **Micro Economic Analysis.** I or II. 3 hr. A study of price and output determination and resource allocation in the firm under various competitive conditions.
212. **Macro Economic Analysis.** I or II. 3 hr. An analysis of the forces which determine the level of income, employment, and output. Particular attention is given to consumer behavior, investment determination, and government fiscal policy.
216. **History of Economic Thought.** I or II. 3 hr. Economic ideas in perspective of historic development.
310. **Advanced Micro Theory I.** I. 3 hr. Theory of production and allocation, utility theory, theory of the firm, pricing in perfect and imperfect markets, models of firm's operations.
311. **Advanced Micro Theory II.** II. 3 hr. PR: Econ. 310. General equilibrium analysis, distribution theory, welfare economics.
312. **Advanced Macro Theory I.** I. 3 hr. Classical, Keynesian, and Post-Keynesian theories.
313. **Advanced Macro Theory II.** II. 3 hr. PR: Econ. 312 Model of economic growth and fluctuations.
316. **History of Economic Doctrines and Analysis.** I. 3 hr. Study of the writings of the major figures in the development of economic doctrines and analysis.
319. **Seminar in Economics.** II. 3 hr.

Quantitative Economics

220. **Introduction to Quantitative Analysis.** I or II. 3 hr. PR: Econ. 125. Study of the principal mathematical techniques employed in economic analysis; and introduction to econometrics.
226. **Advanced Statistics.** II. 3 hr. PR: Econ. 125 or equivalent. An advanced approach to statistical analysis with emphasis on probability, inference, and multi-varied statistical techniques.

320. **Quantitative Analysis.** II. 3 hr. PR: Econ. 220 or consent. Linear programming, input-output analysis, game theory, decision theory, and dynamic models.
325. **Econometrics.** I or II. 3 hr. Specification, statistical estimation, and verification of economic models. Problems of applications of econometric analysis.
329. **Seminar in Economic Analysis.** I or II. 3 hr.

Monetary Economics

330. **Monetary Economics.** I or II. 3 hr. Sources and determinants of the supply of money; the demand for money for transactions and speculative purposes; general equilibrium theory of money, interest, prices, and output; the role of money in policy.
334. **Seminar in Monetary Economics.** I or II. 3 hr.

Public Finance

241. **Public Finance.** I, II. 3 hr. Governmental fiscal organizations and policy; taxes and tax systems with particular emphasis upon the Federal Government and the State of West Virginia.
340. **Theory of Public Finance.** I or II. 3 hr. Systematic study of the economic role of government in a mixed economy with regard to resource allocation between the public and private sectors, the influence of government upon income distribution and upon economic stability and growth.
344. **Seminar in Public Finance.** I or II. 3 hr.

Public Regulation and Control

245. **Government and Business.** I or II. 3 hr. Government in its role of adviser and umpire; analysis of governmental policies and practices affecting business.
246. **Transportation.** I, II. 3 hr. Development of an inland transportation system and relations and policies of transport agencies.
345. **Public Regulation and Control.** I or II. 3 hr. Economic analysis of the public control of enterprises under the jurisdiction of federal and state regulatory authorities.
349. **Seminar in Public Regulation and Control.** I or II. 3 hr.

International Economics

250. **International Economics.** I or II. 3 hr. Development of trade among nations; theories of trade, policies, physical factors, trends, and barriers in international economics.
350. **Advanced International Economics.** I or II. 3 hr. Contemporary theories of international economics; analysis of current problems in world trade and finance.
354. **Seminar in International Economics.** I or II. 3 hr.

Regional Economics

- 255. **Regional Economics.** I or II. 3 hr. Analysis of factors that promote or deter the economic growth of a region, with emphasis on such matters as population shifts, economic base studies, industrial location analyses, input-output techniques, regional income estimation, local multiplier and cycle concepts, and the role of government in regional growth.
- 355. **Advanced Regional Economics.** I or II. 3 hr. Regional income and flow of funds estimation, regional cyclical behavior and multiplier analysis, industrial location and analysis, techniques of regional input-output measurement, the impact of local government reorganization on the level of regional public service and economic development.
- 359. **Seminar in Regional Economics.** I or II. 3 hr.

Labor Economics

- 261. **Trade Unionism.** I or II. 3 hr. PR: Econ. 160 or consent. Analysis of the structure, government, attitudes, and policies of organized labor; the implications of union policy.
- 262. **Collective Bargaining.** I or II. 3 hr. PR: Econ. 160 or consent. Theory and practice of collective bargaining; including contract issues, types of relationships, and the role of government policy.
- 263. **Economics of Wages.** I or II. 3 hr. PR: Econ. 160 or consent. Determination of wage levels and structure; the functioning and organization of labor markets.
- 360. **Advanced Labor Economics.** I or II. 3 hr. Economic effects of trade unionism; measurement and impact of unemployment; the functioning of labor markets; the operation of labor unions; selected aspects of collective bargaining; issues in social legislation.
- 364. **Seminar in Labor Economics.** I or II. 3 hr.

Economic History

- 270. **Strategic Factors in American Economic Growth.** I or II. 3 hr. Regional impact of changing methods of production and distribution.
- 370. **Economic History: Regional Economic Development of the United States.** I or II. 3 hr. The regional development of the Pacific Coast, Southwest, Lower South, the Old Northwest and New England.
- 374. **Seminar in Economic History: The Emergence of Modern Europe.** I or II. 3 hr.

Economic Development

- 213. **Economic Development.** I or II. 3 hr. A comprehensive study of the problems, changes, and principal policy issues faced by non-industrialized countries in the process of economic development.
- 375. **Economic Development.** I or II. 3 hr. An examination of the theory, problems, and policy issues relating to the process of economic development.
- 379. **Seminar in Economic Development.** I or II. 3 hr.

Other Economics Courses

- 390. **Independent Reading in Economics.** I or II. 3-6 hr. Supervised readings in special areas.
- 497. **Research.** I, II. 1-15 hr.

Finance

- 200. **Special Topics.** I, II, S. 1-4 hr. PR: Finance 111 or consent. Study of special topics relevant to finance. Maximum of 9 semester hours in any or all courses numbered 200 offered by this college may be applied toward the bachelor's and master's degrees.
- 216. **Risk Management.** II. 3 hr. PR: Finance 115 or consent. A study of the transferable risks with which the entrepreneur must deal. Emphasis is on the process by which decisions are made for the handling of these risks, including an examination of the contributions and limitations of the insurance system.
- 313. **Financial Administration.** II. 3 hr. PR: Finance 111. A study of problems in business finance including those related to the financial structures of corporations and the working-capital and fixed-capital needs of a firm.
- 329. **Seminar in Finance.** I or II. 3 hr.
- 497. **Research.** I, II. 1-15 hr.

Industrial Relations

- 430. **Seminar in Industrial Relations.** I, II. 1-6 hr.
- 497. **Research.** I, II. 1-15 hr.

Management

- 200. **Special Topics.** I, II, S. 1-4 hr. PR: Management 111 or consent. Study of special topics relevant to management. Maximum of 9 semester hours in any or all courses numbered 200 offered by this college may be applied toward the bachelor's and master's degrees.
- 213. **Problems in Business Administration.** I or II. 1-3 hr.
- 216. **Personnel Management.** I, II. 3 hr. Principles and practices in the direction, coordination, and remuneration of manpower.
- 225. **Business Policy.** I, II. 3 hr. PR: Senior standing and consent. Integrated study of policies, organization, facilities, and control techniques of business enterprises.
- 301. **Administrative Practices.** I. 3 hr. PR: Management 111 or consent. A study of interpersonal relationships through which administration becomes effective. Emphasis is on the human factors, but the influences of economic and technological factors are also considered. Focus is on the importance of harmony between individual needs and organizational goals.
- 302. **Quantitative Business Analysis.** I. 3 hr. PR: Econ. 125 or equiv. A review of probability and Bayesian Statistics, multiple correlation, linear programming, and planning and control techniques with an introduction to data processing through computer solution to problems in these areas.

- 313. **Production Administration.** I. 3 hr. PR: Management 111. The review and application of analytical techniques to complex manufacturing problems.
- 323. **Administrative Policy.** II. 3 hr. PR: Consent. An integrated study of policies, organization, facilities, and control techniques of business enterprises.
- 329. **Seminar in Management.** I or II. 3 hr.
- 497. **Research.** I, II. 1-15 hr.

Marketing

- 200. **Special Topics.** I, II, S. 1-4 hr. PR: Marketing 111 or consent. Study of special topics relevant to marketing. Maximum of 9 semester hours in any or all courses numbered 200 offered by this college may be applied toward the bachelor's and master's degrees.
- 210. **Industrial Purchasing.** I. 3 hr. PR: Marketing 111. A survey of corporate procurement problems facing modern purchasing executives.
- 215. **Marketing Research.** II. 3 hr. PR: Marketing 111. The utilization of marketing research techniques in the solution of practical marketing problems.
- 313. **Marketing Administration.** I. 3 hr. PR: Marketing 111. The analysis of problems met by management in distributing goods and services efficiently to consumers.
- 329. **Seminar in Marketing.** I or II. 3 hr.
- 497. **Research.** I, II. 1-15 hr.



A scene from the University Players' production of "Hello Dolly"

Creative Arts Center

The Creative Arts Center incorporates within a single administrative unit the Divisions of Music, Art, and Drama. The administrative entity was established in 1964. The \$7 million first phase of the Creative Arts Center building was completed in the fall of 1968.

The second phase of this new building, now under construction and to be completed in 1973, will accommodate the expanding academic needs of the disciplines and increase the facilities for the instructional programs. The theatres and galleries, all of modern design, provide public performances and exhibits that make a significant contribution toward fulfilling the cultural needs of the University, the state, and the local area.

Each of the divisions offers various graduate degree programs in its appropriate areas.

DIVISION OF MUSIC

Prospective graduate students in music are required to have completed the appropriate curriculum of undergraduate study in music at West Virginia University, or its equivalent at another institution of recognized standing. For acceptance as a degree student the applicant must:

1. For the Master of Music degree, have an average of 2.5 on all undergraduate study; for the Ph.D. and Doctor of Musical Arts, have an average of 3.0 on the Master's degree or equivalent.

2. Submit to the Division of Music a score of at least 35 on the Miller Analogies Test.

3. Demonstrate by audition or a tape recording a level of attainment on the major instrument no more than one grade-level below the stated entrance level as indicated for the respective curriculum.*

Applicants accepted for degree study must take Entrance Tests in Theory and Music History, and audition on piano. These tests and auditions will be given two days prior to registration. The results of these might indicate the need for remedial study.** Applicants for the areas of Theory and Composition will be tested more specifically in counterpoint (both 16th and 18th century), form, instrumentation, and orchestration. Applicants seeking acceptance as composition majors must also submit representative compositions for evaluation and approval.

*See "Graduate Applied Music Requirements," a listing available at the Applied Music office of the Division of Music.

**Recent graduates of the Division of Music will be admitted on their past record without these entrance examinations, unless these examinations are deemed necessary by the Chairman of the Division of Music.

Applicants who have been admitted to the Graduate School, but whose averages and test scores do not meet the qualifications outlined above, will be accepted as Special Graduates. If upon completion of at least 15 semester hours of graduate study they have maintained a "B" (3.0) average, and when any previous undergraduate deficiencies are removed, such Special Graduates will be accepted as degree students.

The Miller Analogies Test may be taken at any time by appointment at numerous college testing centers around the country. (The Division of Music can supply addresses upon request.) If a tape recording is submitted, it must be of a high quality, 7½ ips, and clearly marked as to name, titles of compositions, and types of tracks used (i.e., half track, quarter track mono, quarter track stereo, etc.). The best recordings still leave much to be desired and a personal audition is encouraged if at all feasible. The auditions are administered, on Saturdays, on announced dates six times throughout the school year and summer. These dates are available upon request. For each semester or the summer session the last date is approximately six weeks prior to registration.

The Degree of Master of Music

Candidates must establish an overall grade-point average of 3.0 (B) within a maximum of 36 hours. Applicants will be admitted to candidacy upon the completion of 12 semester hours of graduate study. No student will be admitted to candidacy until he has removed all undergraduate deficiencies and maintained a 3.0 (B) average in all graduate work completed.

Candidates for the Master of Music degree may major in one of five fields: Music Education, Applied Music, Theory, Composition, History of Music.

Graduate students majoring in Music Education will be allowed one of four options, to be determined in consultation with their adviser: (1) Thesis option; (2) Recital option (if the candidate demonstrates at least grade level of 8½ ability on his major instrument when entering); (3) Thirty-six hour option; and (4) Certification option (intended for persons possessing a bachelor's degree with a major in music). For the first three options there are the following requirements:

1. Thirty graduate hours for thesis and recital options, thirty-six graduate hours otherwise, with an average of 3.0 (B).
2. Required courses: Music 410, Music 444, Music 446, one course each in the areas of theory and music history, and either Music 440 or Music 442.
3. Achievement of grade level 8 on the major instrument.
4. Passing of an oral examination in areas of music education, music history, and music theory.
5. Successful completion of a 4-hour thesis or 2-hour recital for the thesis and recital options, respectively.

For the certification option, a special selection of approximately 21 hours is made in cooperation with the Division of Education to satisfy certification requirements. The other hours, to make a total of 36, are electives to provide a good background for teaching. Undergraduate courses may be required to make up deficiencies in areas of performance or conducting.

The following are the five curricula:

History of Music		Music Education (with thesis)	
(Prerequisite: 12 undergraduate hours in Music History and Literature, such as Music 33, 34, 231, 232, 330, 331, 332, 333, or equivalents.)		M. 410—Conducting	3
M. 430—Intro. to Musical Biblio....	2	M. 440—Choral Techniques, or	
M. 431—Intro. to Musical Biblio....	2	M. 442—Instrumental Techniques	2
M. 432—Music in Middle Ages	3	M. 444—Music Education.....	3
M. 433—Music in Renaissance	3	M. 446—Introduction to Research	
M. 436—Music in Baroque Period .	3	in Music Education	3
M. 437—Music in Classic and		M. 497—Research (thesis)	4
Romantic Periods	3	Music Electives (at least one	
M. 467—Analytical Techniques	3	course each in theory and	
M. 497—Research	2	music history)**.....	15
M. 497—Research (thesis)	4		—
Electives*	5		30
	30		
Theory		Applied Music	
M. 430—Intro. To Musical Biblio.	2	M. 400—Applied Music	
One of the following.....	3	(major instrument)	8
M. 432—Music in Middle Ages—3		M. 430—Intro. to Musical Biblio.	2
M. 433—Music in Renaissance—3		Two of the following courses.....	6
M. 436—Music in Baroque		M. 432—Music in Middle Ages—3	
Period—3		M. 433—Music in Renaissance—3	
M. 437—Music in Classic and		M. 436—Music in Baroque	
Romantic Periods—3		Period—3	
M. 449—Psychology of Music.....	3	M. 437—Music in Classic and	
M. 467—Analytical Techniques	3	Romantic Periods—3	
M. 470—Orchestration	2	M. 332—Studies in Contemporary	
M. 475—Pedagogy of Theory	3	Music—3	
M. 481—Nonserial Techniques of		A course (or courses) from the	
20th Century Composition	2	Theory and/or Composition	
M. 482—Serial Techniques	2	offerings—minimum.....	3
M. 497—Research (thesis)	4	One of the following courses	2
Electives*	6	M. 496—Lecture Recital—2	
	—	M. 497—Research—2	
	30	M. 498—Recital	4
		Music Electives (no more than	
		4 hr. in the major applied	
		music area)	5
			—
			30

*To be eligible for graduation the candidates must demonstrate completion of grade level 8 on their major instrument.

**To be eligible for graduation, the candidates must present evidence of musicianship through accomplishment of grade level 8, or through demonstration of skill in conducting, or through demonstration of various performance skills important in elementary school teaching (recorder, guitar, piano, Orff instruments, etc.).

Composition	Hr.
One of following	3
M. 432—Music in Middle Ages—3	
M. 433—Music in Renaissance—3	
M. 436—Music in Baroque Period—3	
M. 437—Music in Classic and Romantic Periods—3	
M. 467—Analytical Techniques	3
M. 460—Composition	6
M. 470—Orchestration.....	2
M. 475—Pedagogy of Theory	3
M. 481—Nonserial Techniques of 20th Century Composition	2
M. 482—Serial Techniques	2
M. 497—Research (thesis)	4
Electives.....	5

30

A representative public recital is required of candidates majoring in Applied Music. Composition majors must submit as a thesis a composition in a large form.

All candidates for the Master of Music degree are required to participate at least two clock hours per week for two semesters (or summer terms) in a performing group selected with the approval of the adviser.

A general comprehensive oral examination must be passed by all candidates for the Master of Music degree. Candidates may repeat this examination after a three-month period. The results of the second oral examination will normally be considered final. The examining committee will decide immediately after an unsuccessful second attempt whether a petition for a third attempt will be granted.

The Degree of Doctor of Philosophy

Admission. Applicants to the program leading to the degree of Doctor of Philosophy must present necessary credentials for evaluation of previous training and experience to the Graduate Department of the Division of Music. This includes a score on the Miller Analogies Test, a transcript of all grades, and must show proof that the applicant has had a minimum of 28 semester-hours in liberal arts studies. Prior to admission to the program the Department may, at its discretion, require the applicant to take entrance tests in various fields of music, or it may require the applicant to present himself for a personal interview. Under normal circumstances the applicant must have attained an average grade of B in courses taken for his Master's degree. However, if sufficient professional experience should warrant, the Department may waive the requirement of a B average or may grant an applicant conditional admittance subject to the satisfactory completion of certain specified courses or the attainment of a specified grade-point average within a semester's work.

Candidacy. Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are (in order of occurrence):

1. Demonstrate the ability to read German and French (only one of the two for applicants in Music Education). (Upon recommendation of the adviser and with the approval of the Dean of the Graduate School, one other language may be substituted for French or German).

2. Pass written examinations satisfactorily to show:

- a. Broad knowledge in "Theory" and "Music History and Literature."
- b. Knowledge in depth in the field of specialization.

3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.

4. Present and have accepted an outline and prospectus of the dissertation.

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final.

Fields of Specialization. Candidates shall select a program within one of the following fields of specialization: (1) Theory; (2) Music Education; (3) Musicology. In addition, a minor field consisting of a minimum of 12 credit hours in another field of music or a cognate field will be required of all candidates and will be chosen with the approval of the adviser. If the candidate's specialization is in Musicology, the minor field will ordinarily be chosen from an appropriate area of Humanities.

Curriculum. The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the doctoral committee in the light of the candidate's previous preparation and his field of specialization.

Residence. In general, the requirements for the degree of Doctor of Philosophy contemplate at least three years of full-time graduate work. A minimum of two semesters is required in residence in full-time graduate study at West Virginia University beyond the master's degree or its equivalent.

Dissertation. The candidate must submit a dissertation produced at West Virginia University under the direction of a major professor which demonstrates a high order of independent scholarship,

originality, competence in research, and an original contribution to the field of specialization.

Final Examination. If the candidate's dissertation is approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his doctoral committee. At the option of his committee, a written examination may also be required. The final examination(s) shall be concerned with the dissertation, its contribution to knowledge, its relation to other fields, and the candidate's grasp of his field of specialization.

Time Limitation. Requirements for the degree of Doctor of Philosophy must be completed within seven years.

The Degree of Doctor of Musical Arts in: Performance and Literature; Composition

Admission. Applicants to the program leading to the degree of Doctor of Musical Arts must present necessary credentials for evaluation of previous training and experience to the Graduate Department of the Division of Music. For performance this includes copies of programs of recent major recitals, a transcript of all grades, and must show proof that the applicant has had a minimum of 28 semester hours in liberal arts studies. The applicant must also be approved for the program by an Audition Committee, by giving evidence of superior performance, artistic maturity, and extensive repertoire as specified under Graduate Applied Music Requirements. The Audition Committee shall consist of the Chairman of the Division of Music, the Chairman of the Applied Music Department, and the major professors involved with the degree. For composition the applicant must be approved for the program by an Evaluation Committee on the basis of scores presented of his works, accompanied by recordings if possible, which will show a successful handling of various forms and media and indicate the capacity to attain professional standing in his field. To be admitted to the program the applicant must have attained an average grade of B in courses taken for his Master's degree.

Candidacy. Graduate students meeting the requirements of the Division of Music and the general requirements of the Graduate School will be recommended to the Dean of the Graduate School for admission to candidacy for the degree. These requirements are (in order of occurrence):

1. Demonstrate minimal acquaintance with German and French by the completion of German 2 and French 2 (or their equivalents) with a grade of "C" or better. (Students may petition to substitute Italian or Spanish for French.)
2. Pass written examinations satisfactorily to show:
 - a. Broad knowledge in Theory and Music History and Literature.
 - b. Knowledge in depth in the literature of the field of specialization (performance only).

3. Pass satisfactorily a comprehensive oral examination covering the entire field of music.

4. Present a public recital (performance only).

Graduate students who have met these requirements and who have maintained an average of B in courses completed shall be admitted to candidacy. Should the applicant fail the written examinations he may apply to take them again after a minimum period of three months. Should the applicant fail the comprehensive oral examination he may be examined again after a minimum period of six months. The results of the second oral examination will be considered final.

Fields of Specialization. The degree of Doctor of Musical Arts is offered in the area of Performance and Literature in the fields of specialization of (1) Piano, (2) Voice, and (3) Organ and in Composition.

Curriculum. The exact amount and nature of course work to be undertaken by a candidate will be determined by the adviser with the approval of the Doctoral Committee in the light of the candidate's previous preparation and his field of specialization.

Residence. In general, the requirements for the degree of Doctor of Musical Arts contemplate at least three years of full-time graduate work. A minimum of two semesters is required in residence in full-time graduate study at West Virginia University beyond the master's degree or its equivalent.

Recitals, Performance, and Research (performance only). Recital, performance, and research requirements should be the equivalent to approximately 20 credit hours. A prospectus indicating the various performances and/or projects to be presented for the satisfaction of these requirements will be drawn up by the candidate with the help of his major professor, and submitted to his doctoral committee for approval. (Approximate credit-hour equivalents to be established by the candidate's committee are: solo recital, 3-5; written research project, 3-5; major opera role, 2-4; lecture recital, chamber music program, concerto, major oratorio role, 2.) This prospectus should display a variety of kinds of music and types of presentations appropriate for the preparation of an artist-teacher, and may include solo recitals, lecture recitals, chamber music programs, concerto performances, major roles in opera or oratorio, or written research projects. It would include two solo recitals and normally will at least include either a research project or one lecture recital. Approximately one-half of the 20-credit hours bloc must be earned after admission to candidacy.

Compositions and Research (composition only). Composition and research requirements should be the equivalent to approximately 20 credit hours. "Equivalent credit" will be assigned by the student's doctoral committee on the basis of four to seven credits for a major work (symphony, opera, etc.) and fewer credits

for lesser works. Credits may be assigned both on a qualitative and a quantitative basis. Proposed works will be approved by the Committee to insure that sufficient variety and breadth of compositional experience is included. Normally, at least one major work will be required. Credits of 2 to 4 hours will be included for a written paper such as an analysis of a twentieth century composition.

Final Examination. If the candidate's compositions, project, and recitals (as the case may be) are approved and he has fulfilled all other requirements, he will be admitted to the final oral examination before his Doctoral Committee. At the option of his Committee, a written examination may also be required. The final examinations(s) shall be concerned with the compositions, the project (if any), and the candidate's grasp of his field of specialization and its relation to other fields.

Time Limitation. Requirements for the degree of Doctor of Musical Arts must be completed within seven years.

The Degree of Doctor of Education

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education. The sequence of prerequisites to admission, prerequisites to candidacy, and requirements for the degree are set out in the Education section of this bulletin. The requirements for the degree of Doctor of Education for students in music are identical with those for students in education, except that, for students in music, a maximum of 24 semester hours of graduate work pursued in fulfillment of the requirements for the Master's degree or its equivalent, if of suitable character and quality, may be credited toward the doctorate.

Music

Applied Music

218. **Repertoire.** I. 0-2 hr.

219. **Repertoire.** II. 0-2 hr.

400. **Applied Music.** I, II. 1-4 hr. Open to qualified students in any field in Applied Music. Course number may be repeated as many times as necessary or desirable. A student must demonstrate ability of grade-level 4 on an instrument to receive credit in Music 400 on that instrument. Students other than music majors may take a maximum of one 30-minute lesson per week. If such students demonstrate ability of grade-level 7, this may be at 2 credits (hr.); otherwise, the maximum for such students is 1 credit (hr.).

409. **Master Class in Applied Repertoire.** I, II. 2 hr. PR: Consent. A master class designed to give coverage through performance of the literature of a specific D.M.A. Applied Music field. Courses may be repeated for credit.

Conducting

- 410. **Conducting. I.** 3 hr. PR: Music 52 or equiv. A graduate course in instrumental and choral conducting. Major works are prepared and conducted through the use of recordings and the large University music organizations.
- 411. **Conducting. II.** 3 hr. PR: Music 410.

Literature

- 230. **Music of Africa. I, II.** 3 hr. A survey of the traditional music of selected areas of Africa south of the Sahara with particular reference to East Africa. Study of the diverse musical cultures with emphasis on the historical background, instruments, ensembles, forms, and styles, and the music in its social context.
- 231. **History of Music. I.** 3 hr. Survey of music history from the pre-Christian era to the baroque.
- 232. **History of Music. II.** 3 hr. Survey of music history from the baroque to the contemporary period.
- 330. **Survey of Vocal Music. I.** 3 hr. PR: Music 33-34 or equiv. and consent. A survey of masses, oratorios, cantatas, and operas from the late Renaissance to the twentieth century. Solo repertoire will not be included.
- 331. **Survey of Instrumental Music. II.** 3 hr. PR: Music 33-34 or equiv. and consent. A survey of instrumental ensemble music, chamber music, concertos, symphonies and other orchestral music from the late Renaissance to the twentieth century. Solo repertoire will not be included.
- 332. **Studies in Contemporary Music. I.** 3 hr. PR: Music 34 or equiv. and consent.
- 333. **Survey of Chamber Music.** 3 hr. PR: Music 34.
- 334. **Collegium Musicum. I, II.** 1-2 hr. Performance of outstanding musical works not in the standard repertory. Although open as a performance group to upperclassmen, graduate students will select appropriate vocal and instrumental music, investigate modes of performance, prepare any necessary editions, and direct rehearsals under supervision. May be repeated for credit.
- 423. **Keyboard Literature. S.** 3 hr. PR: Music 218, 219. An intensive study of the literature for keyboard instruments and the history of the literature.
- 424. **Song Literature. S.** 3 hr. PR: Music 218, 219. An intensive study of the Art Song and the Lied and the history of their development.
- 430. **Introduction to Musical Bibliography. I.** 2 hr. PR: Music 33, 34 or equiv. A survey of musical bibliography with appropriate research assignments.
- 431. **Introduction to Musical Bibliography. II.** 2 hr. PR: Music 430. Continuation of Music 430 with emphasis on the individual student's field of specialization and more detailed research problems.
- 432. **Music in the Middle Ages. I.** 3 hr. PR: Music 33, 34 or equiv. and consent. A detailed study of the music and musical practice from the beginning of the Christian era to 1400.
- 433. **Music in the Renaissance. II.** 3 hr. PR: Music 33, 34 or equiv. and consent. Continuation of Music 432 through the sixteenth century.

436. **Music in the Baroque Period.** I. 3 hr. PR: Music 33, 34 or equiv. and consent. A detailed study of the music and musical practice of the period from 1600 to 1750.
437. **Music in the Classic and Romantic Periods.** II. 3 hr. PR: Music 33, 34 or equiv. and consent. Continuation of Music 436 covering the period from 1750 to 1900.
438. **History of Notation.** S. 3 hr. PR: Music 33, 34 or equiv. A detailed study in transcribing the musical manuscripts of the Middle Ages.
439. **History of Notation.** S. 3 hr. PR: Music 33, 43 or equiv. Continuation of Music 438 covering the Renaissance Period.

Church Music

429. **Survey of Sacred Music.** S. 4 hr. PR: Music 33, 34 or equiv. A study of music suitable to the liturgical year, including the historical background of the Jewish, Catholic, and Protestant liturgies.

Music Education

340. **Band, Orchestra, Choral, Opera Theatre, and Music Education Clinics.** 1-2 hr. Special problems of organization and development of the various performing organizations. Lecture, laboratory and discussion groups.
341. **Music in the Elementary School.** I, II. 3 hr. PR: Music 30, 41, 42 or consent. Development of skills, procedures, techniques, and materials used by the general classroom teacher of music in grades 1-8. Not open to music majors.
342. **The Teaching of Music Appreciation.** 3 hr. PR: Music 30, 41, 42 or equiv. A review of information, materials, sources, and techniques involved in teaching appreciation of music in the public schools. Not open to music majors.
343. **Contemporary Techniques in Classroom Music.** 3 hr. PR: Music 152 or consent. Intensive study of the principles and practice of contemporary techniques in elementary and junior high school classroom music, including those of Orff and Kodaly.
346. **Music in the Junior High School.** 2 hr. PR: Music 151, 152 or equiv. A consideration of the potentialities and special needs of the junior high school in music education; programs, procedures, and materials.
440. **Choral Techniques.** II. 2 hr. PR: Music 151, 152 or equiv. A study of advanced techniques and procedures involved in the development of ensembles.
442. **Instrumental Techniques.** I. 2 hr. PR: Music 151, 152 or equiv. A study of advanced techniques and procedures involved in individual performance and instruction through lecture-demonstrations by the applied music faculty.
444. **Music Education.** II. 3 hr. PR: Music 151, 152 or equiv. Survey and critical study of the total music education program.
445. **The Supervision of Music.** 2 hr. PR: Music 151 or 152 or equiv. The study of concepts, responsibilities, duties and techniques that the supervisor needs to effectively exercise leadership in developing, coordinating, and refining the complete Music Education program in the public schools from the kindergarten through the 12th grade.

446. **Introduction to Research in Music Education.** I, 3 hr. PR: Music 151, 152 or equiv. A study of methods and measures necessary for the conduct and understanding of research in music education.
448. **Psychology of Music Learning.** II. 3 hr. The application of learning theory to music learning; the nature of musical talent; music talent testing.
449. **Psychology of Music.** I. 3 hr. An introductory study of musical acoustics and psychology of perception of music.
452. **Aesthetics of Music.** II. 2 hr. PR: Music 33, 34 or consent. An examination of the main classical and contemporary aesthetic theories and their applications to music.

Opera

419. **Opera Theatre.** I, II. 0-4 hr. PR: Music 19 or consent. Continuation of Music 19. Performance of major roles and advanced production techniques. Qualified students will undertake production-direction projects under supervision.

Theory and Composition

260. **Upper Division Composition.** 2 hr. PR: Four semesters Music 160, or consent based on scores submitted. Creative writing with emphasis on practical composition for performance. May be repeated for credit.
263. **Counterpoint.** I. 2 hr. PR: Music 68 or consent. Sixteenth century counterpoint.
264. **Counterpoint.** II. 2 hr. PR: Music 68 or consent. Eighteenth century counterpoint.
265. **Analysis of Musical Form.** I. 3 hr. PR: Music 68 or consent. A detailed study of the structure of music.
267. **Electronic Music.** I. 2 hr. PR: Music 68 and consent. A study of the technology of producing electronic music. This will include a study of the methods of producing electronic compositions, the relationship between sound signal and sound perceived, ear training, analysis of examples from electronic music literature, and composition of electronic music.
268. **Electronic Music.** II. 2 hr. PR: Music 267. A continuation of Music 267.
380. **Remedial Theory.** I, II. 0 hr. A course for graduate students who are deficient in undergraduate theory requirements.
460. **Composition.** I, II. 3 hr. PR: Consent. A course primarily for candidates for the graduate degrees in Theory or Composition. Course may be repeated for credit.
467. **Analytical Techniques.** I. 3 hr. A study of various theories of musical analysis and their application.
470. **Orchestration.** I, II. 2 hr. PR: Music 172 or equiv. Major projects of orchestration. Course may be repeated for credit; maximum credit 6 hours.
472. **Band Arranging.** II. 2 hr. PR: Music 172 or equiv. Major projects in arranging for the concert band.

- 475. **Pedagogy of Theory.** II. 3 hr. PR: Music 68 and consent. Consideration of the various approaches to the teaching of theory.
- 481. **Nonserial Techniques of 20th Century Composition.** I. 2 hr. A theoretical and analytical course including the application of various techniques in student compositions.
- 482. **Serial Techniques.** II. 2 hr. A theoretical and analytical course including the application of serial techniques in student compositions.

Research or Recital

- 492. **Advanced Studies in Music.** I, II. 2-8 hr. PR: Consent of the instructor which in some cases may be contingent upon doctoral foreign language examination or a course in statistics. Primarily intended for Ph.D. candidates. Intensive individualized reading reported in group discussions. Course may be repeated as many times as necessary, in as many areas as needed, and several different sections (i.e. areas) may be pursued simultaneously.
- 493. **Recital.** 2 hr. For Music Education majors only.
- 494. **Doctoral Seminar.** I, II. 2 hr. PR: Consent. Intensive individual investigation and preparation of research papers. Course may be repeated for credit; maximum credit 8 hours. Presented by the combined doctoral staff in music.
- 495. **Dissertational Guidance.** I, II. 1-12 hr.
- 496. **Lecture Recital.** 2 hr. PR: Music 430.
- 497. **Research.** I, II. 1-15 hr. PR: Music 430 or consent.
- 498. **Recital.** 1-4 hr. PR: Music 299 (Senior Recital) or equiv.

Applied Music Requirements*

Major Instrument

Applied Music Majors. All entering graduate students majoring in Applied Music must demonstrate by audition grade-level 10 ability on their major instrument to be accepted for that area.

Music Education, History of Music. All entering graduate students majoring in these areas must demonstrate by audition grade-level 7 ability on their major instrument, and to be eligible for graduation must demonstrate grade-level 8 ability.

Theory, Composition. All entering graduate students majoring in these areas must demonstrate by audition grade-level 8 ability on their major instrument.

Doctor of Philosophy. All entering graduate students for the Ph.D. must demonstrate performance ability on the major instrument to the satisfaction of the Admissions Committee.

Piano

Music Education. All entering graduate students in Music Education must demonstrate Piano ability to satisfy either grade-level 2 (for instrumentalists) or 3 (for vocalists).

*Graduates of the Division of Music may enter on their past record of grade-level achievement without audition, unless an audition is deemed necessary by the Chairman of the Division of Music.

Theory, Composition. All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 4.

Applied Music, History of Music. All entering graduate students majoring in these areas must demonstrate Piano ability to satisfy grade-level 3.

Courses in Applied Music

See the Applied Music Office of the Division of Music for a listing of applied music courses on the graduate level.

DIVISION OF ART

Candidates for the degree of Master of Arts in Art must have an undergraduate degree majoring in Art, Art Education or the equivalent. Before being admitted to the degree program the student must demonstrate visual ability through the presentation of a portfolio.

The portfolio will consist of a minimum of 20 slides and/or photographs representing at least ten pieces of work. Slides or photographs must be numbered to correspond to their description. The description should indicate size and media of work and briefly explain the problem undertaken. Each portfolio, slides and photographs should clearly indicate the name and address of the applicant.

The portfolio is addressed to the Chairman, Division of Art, Creative Arts Center, West Virginia University. The University is not responsible for loss or damage to portfolios. The candidate assumes all mailing and insurance cost relating to the portfolio requirement.

Division requirements for the degree are as follows:

1. Completion of a minimum of 30 semester hours of graduate work, including not more than 6 hours in thesis or 3 hours in thesis project.
2. Completion of an approved thesis or thesis-project.

With the consent of his committee, the student may elect a maximum of 6 hours in a related subject.

Art

- 211. **Figure Drawing.** I. II. 3 hr. PR: Art 12, 122 or equiv. A drawing course in compositional structure from the figure.
- 213. **Painting.** I. 3 hr. PR: Art 118 or equiv. An advanced painting course emphasizing problems, techniques and media. (Offered in evening).
- 214. **Painting.** II. 3 hr. PR: Art 213 or equiv. Continuation of Art 213. (Offered in evening).
- 216. **Painting.** I. 3 hr. PR: Art 214 or equiv. A senior tutorial painting course. (Offered in evening).
- 217. **Painting.** II. 3 hr. PR: Art 216 or equiv. A senior tutorial painting course. (Offered in evening).

- 220. **Art and the Schools.** I. 2 hr. PR: 4 hr. of Art, including a minimum of 2 hr. studio. The function of art in the curriculum at various grade levels, a study of standards of achievement and materials and methods.
- 230. **Printmaking.** I. 3 hr. PR: 6 hr. printmaking or equiv. An exploration of conventional and experimental printmaking techniques.
- 231. **Printmaking.** II. 3 hr. PR: Art 230 or equiv. An extension of Art 230.
- 250. **Renaissance Painting.** I. 3 hr. PR: Art 105, 106, or equiv. The study of painting in Italy from 1400 to 1600. (Offered in evening).
- 260. **Modern Painting.** II. 3 hr. PR: Art 105, 106, or equiv. Developments in painting from the French Revolution to the present day. (Offered in evening).
- 310. **Painting.** I, II. 3-9 hr. PR: 12 hr. of painting or equiv. May be repeated for a maximum of 9 hr. Independent studio work with interdisciplinary critiques. (Offered in evening).
- 320. **Printmaking.** I, II. 3-9 hr. PR: 12 hr. of printmaking or equiv. Independent studio work with interdisciplinary critiques.
- 321. **Administration and Supervision of Art.** II. 2 hr. PR: Art 220 or equiv. Mainly for administrators and school principals who wish to become informed about art programs and the philosophies underlying them.
- 325. **Secondary School Art.** II. 3 hr. PR: Art 12, 122, 114 or equiv. Information and working skills desirable for the teaching of art on the secondary school level.
- 326. **Sculpture.** I, II. 3-9 hr. PR: 12 hr. of sculpture or equiv. May be repeated for a maximum of 9 hr. Independent studio work with interdisciplinary critiques.
- 390. **Study of Original Works of Art.** S. 6 hr. PR: Art 105, 106, or consent. Directed study in the museums and libraries in an urban center such as Washington or New York; a study of the architectural developments of the locality.
- 451. **Special Topics.** I, II. 1-3 hr. per sem. (May be repeated for a maximum of 12 hr.) PR: Consent. Individual study to be determined by the student's requirements.
- 497. **Research.** I, II. 1-15 hr.

DIVISION OF DRAMA

The Degree of Master of Arts

Prospective applicants who possess a bachelor's degree from an accredited college or university may be admitted to the program. Any deficiencies in undergraduate preparation in upper-division courses in Drama appropriate to the anticipated area of specialization will be made up either without credit or (in instances of 200 or above numbered courses) added to the credit required for the degree.

1. Successful completion of the minimum number of required graduate hours as set forth in Program "A" or Program "B" below.
2. Completion, within the framework of the Graduate School and Division of Drama standards, of one of the two following programs of study:

A. Concentration program which meets the following requirements:

- (1) Successful completion of at least a minimum of 30 semester hours of graduate credit. No more than 9 of the 30 credit hours will be in research and thesis.
- (2) Successful passage of comprehensive written examination in the fields of study. Such examinations are administered toward the end of the student's course work and then only if and when the student has a "B" grade-point average or 75 per cent of his credit hours are of "B" grade or higher.
- (3) Submission for approval by the student's graduate committee of a thesis demonstrating original research and scholarly reporting.
- (4) Successful completion of an oral examination on the thesis.

B. General program which meets the following requirements:

- (1) Similar to above program (A) with a total of 36 hours required. The six additional hours to be substituted for the thesis requirement and to be taken in drama or cognate fields upon the approval of the faculty adviser.
- (2) Successful passage of comprehensive examinations, both written and oral, in all areas of Drama. Either a 3.0 (B) grade-point average or 75 per cent of "B" grades for the hours carried is prerequisite to taking comprehensive examinations.

3. The student pursuing Program A or Program B will emphasize either a directing or a design specialty, oriented toward a professional or teaching career in drama.

Thesis Program

<i>First Sem.</i>	<i>Hr.</i>	<i>Second Sem.</i>	<i>Hr.</i>
Drama 431	3	Drama 400	3
Drama 460	3	Drama 460	3
Drama 200 level courses.....	6	Drama 497	3
		Drama 200 level course	3
	12		12

Summer Session or Regular Term

Drama 497	3
Drama 460	3
	6

Non-Thesis Program

<i>First Sem.</i>	<i>Hr.</i>	<i>Second Sem.</i>	<i>Hr.</i>
Drama 431	3	Drama 400	3
Drama 460	3	Drama 460	3
Drama 200 level courses.....	9	Drama 497	3
		Drama 200 level courses.....	6
	— 15		— 15

Summer Session or Regular Term

Drama 497	3
Drama 200 level course	3
	— 6

Drama

202. **Advanced Scene Design. II.** 3 hr. PR: Drama 100, 102, or consent. Lecture and laboratory in theories of scene design for stage and television, including actual construction of designs. Open to juniors, seniors, and graduate students.
203. **Advanced Theatre Lighting Design. I.** 3 hr. PR: Drama 103 or consent. Advanced theories of lighting and design for the stage. Course includes practical experience with advanced lighting equipment.
204. **Advanced Costume Design. II.** 3 hr. PR: Drama 104 or consent. Individual study in design styles and techniques. Survey of the position of costume design in theatre today.
250. **Advanced Problems in Interpretation. II.** 3 hr. PR: Drama 50 and consent. Designed to deal with individual problems of advanced students in interpretation.
251. **Professional Reading. I, II.** 3 hr. PR: Consent. Intensive training in interpretation. Designed to meet needs of individual. Full length public recital prepared and presented. Limited enrollment.
252. **Art of Storytelling. S.** 3 hr. PR: Consent. Principles involved in effective presentation of stories, with practical experience in classroom and before audiences. Stories of all types for adults and children studied.
260. **Theatre Performance and Rehearsal Laboratory. I, II.** 1 to 3 hr. PR: Drama 161 or consent. Participation in assigned theatre projects. Appreciation of creativity and performance techniques in theatre. Majors only. Maximum credit, 6 hr.
275. **Advanced Acting. II.** 3 hr. PR: Drama 75 and consent. Characterization, script analysis, style, theories, and techniques. Designed to meet needs of individual student.
276. **Actors Studio.** 1 hr. PR: Drama 76, 176, 275 or consent. Advanced laboratory experience in acting and production styles of historical and modern theatre through the use of staged scenes.
280. **Advanced Play Directing. II.** 3 hr. PR: Drama 180, or consent. Emphasis on work of directing as an integrating artist. Display of high level of proficiency in direction of a one-act play required of all students enrolled.

281. **Theatrical Dialects.** I. 3 hr. PR: Consent. Study and mastery of fifteen common dialects used in theater and radio.
282. **Creative Dramatics.** I. 3 hr. PR: Drama 75 or consent. The study and practice of creative dramatic activity as a method of learning and self development for children.
284. **Puppetry.** I. 3 hr. PR: Drama 75 or consent. A comprehensive survey of construction and manipulation techniques of puppets. Includes an evaluation of the role of puppetry in child behavior and therapy techniques.
285. **Advanced History of Theater.** II. 3 hr. Historical survey of theater from primitive time to present. Includes both oriental and occidental theaters.
286. **Drama Criticism and Aesthetics.** I. 3 hr. A survey of chief critical and aesthetic theories of drama-ancient, modern contemporary.
290. **Playwriting.** II. 3 hr. PR: Consent. Development of creative ability in dramatic composition. Study of techniques and problems of playwriting. Of cultural value, but primarily a writing course.
375. **Styles of Acting and Directing.** II. 3 hr. PR: Drama 180, Drama 175 or consent. Extensive and intensive study of directing and acting styles.
400. **Applied Creative Performance.** 3 hr. Creative projects and/or performance. Must have faculty approval as part of student's graduate program.
431. **Research Methods and Survey.** 3 hr. PR: Consent. Research methods and techniques and general survey of the field of drama.
444. **Survey of Educational Methods and Practices.** 3 hr. Survey and critical study of the total drama education program.
460. **Specialized Seminars.** 3-9 hr. PR: Consent. Selected fields of study in drama. (May be repeated for a maximum of 9 credit hours).
497. **Research.** I, II. 1-15 hr.

College of Engineering

Requirements for Admission

A student desiring to take courses for graduate credit in the College of Engineering must first comply with the appropriate regulations of the Graduate School.

A student who intends to become a candidate for a degree must apply for admission through the Office of Admissions and Records to the major department of his choice. Acceptance by the major department will depend upon review of the student's academic background and the available facilities in the department.

An applicant with a baccalaureate degree, or its equivalent, from a department accredited by the Engineers' Council for Professional Development will be admitted on the same basis as engineering graduates of West Virginia University. Lacking these qualifications, an applicant must first fulfill the requirements of the department in which he is seeking an advanced degree.

Admission to candidacy for a graduate degree is required prior to obtaining that degree. A graduate student may apply for admission to candidacy by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-point average of at least 3.0, based on all graduate courses, taken in residence, for which he has received a grade at the time of application.

Academic Standards and Curricula

No credits which are reported with a grade lower than C are acceptable toward an advanced degree.

To qualify for an advanced degree, the graduate student must have a grade-point average of at least 3.0 based on all courses acceptable for graduate credit for which he has received a grade from the University.

A graduate student in the College of Engineering must comply with the regulations of his major department.

The Degree of Master of Science

Each department in the College of Engineering has a designated M.S. degree and in addition the College has an undesignated degree, Master of Science in Engineering. For all M.S. degrees each candidate will, with the approval of his graduate committee,

follow a planned program which must contain a minimum of 30 semester credit hours no more than 12 of which can be at the 200 level. If a thesis or a problem report is part of the candidate's program, not more than 6 semester credit hours of research leading to an acceptable thesis nor more than 3 semester credit hours of work for an acceptable problem report may be applied toward the semester credit hour requirement.

Individual departments may establish minimum requirements greater than those adopted for the College as a whole; these departmental requirements are contained in this catalogue.

The Master of Science in Engineering program is designed for students who desire to pursue work in areas other than that of their baccalaureate degree in engineering or science. Graduate students who wish to become candidates for this degree should register with the department in which the major portion of the work is to be done.

The Degree of Doctor of Philosophy

The departments approved for participation in this program are: Aerospace Engineering, Chemical Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, and Theoretical and Applied Mechanics.

Admission. Admission to the Graduate School of West Virginia University is required of all applicants for admission to a program of study and research leading to the Ph.D. Applicants for admission are expected to have successfully completed a Bachelor of Science or Master of Science degree program in some phase of engineering equivalent to the program leading to this degree in effect at West Virginia University. Admission to the Graduate School does not necessarily assure entrance into the College of Engineering Ph.D. program.

Requirements for Candidacy. After admission to the program and after a period of residence, the applicant will be admitted to a comprehensive preliminary or qualifying examination (either oral or written or both) in which he must demonstrate: (a) a grasp of the important phases and problems of the field of study in which he proposes to major and an appreciation of their relation to other fields of human knowledge and accomplishments; and (b) the ability to employ rationally the instruments of research developed in his major field. In addition, the student must satisfy the foreign language requirements of the Graduate School.

When an applicant has successfully passed his comprehensive examination he will be formally admitted to candidacy for the Doctor's degree. Admission to candidacy must precede the final examination for the Doctor's degree. Graduate courses pursued in fulfillment of the requirements for the Master's degree, if of

suitable character and quality, may be credited toward the doctorate.

Curriculum. The degree of Doctor of Philosophy is not awarded for the mere accumulation of course credits nor for the completion of a definite residence requirement. The exact amount and nature of the course work to be undertaken by a candidate will be established for each individual candidate with the object of insuring a rational and coherent progression of academic development beyond the Bachelor of Science degree.

Residence. The requirements for the degree of Doctor of Philosophy contemplate approximately three years of full-time graduate work beyond the Bachelor's degree. A minimum of 36 weeks in residence in full-time graduate study or its equivalent at West Virginia University is required, and must include a minimum of two semesters at WVU.

Dissertation. The candidate must submit a dissertation on a topic within the area of his major interest. The dissertation must represent the results of independent research and must constitute a definite contribution to knowledge. It is anticipated that the work leading to the completion of the dissertation would require 24 hours in research and/or dissertation credits or satisfactory evidence of equivalent time devoted to research and preparation of the dissertation.

Final Examination. Upon completion and approval of the dissertation and fulfillment of all other requirements, the candidate shall pass a final examination conducted by a committee of at least five members recommended by the major department and appointed by the Dean of the Graduate School. The examination shall be primarily a defense of the dissertation although other questions necessary to establish the validity of the dissertation may be in order.

AEROSPACE ENGINEERING

Master of Science in Aerospace Engineering

Students must comply with rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Thesis. Normally a thesis is required of all candidates for the degree of Master of Science in Aerospace Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the Department of Aerospace Engineering.

Whether or not a thesis is required shall be determined by the department and shall be recorded in the student's file as a part of his planned program.

Final Examination. Each candidate for the master's degree shall pass a final examination administered by his Advisory and Examining Committee.

Courses. The following grouping of courses is given as a guide for selecting a graduate program leading to the degree of Master of Science in Aerospace Engineering:

Group I. Required of all candidates. Six semester credit hours of advanced mathematics beyond a first course in differential equations.

Group II. Major. Minimum of 9 semester hours of Aerospace Engineering courses, other than A.E. 497, in the 200, 300 and 400 series.

In order to meet the minimum requirements for the degree of Master of Science in Aerospace Engineering, additional courses may be taken from the following, subject to the approval of the student's Advisory and Examining Committee:

1. Courses from Groups I and II.
2. Aerospace Engineering courses in the 200 series which are not required for the degree of Bachelor of Science in Aerospace Engineering of West Virginia University.
3. Physics and Chemistry courses in the 200 to 400 series.
4. Courses in other departments of the College of Engineering in the 200 to 400 series.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in General Requirements for graduate work in the College of Engineering.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, may be required to attain a proficiency in each of the following areas: (1) fluid mechanics, (2) thermodynamics, and (3) applied mathematics.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the field of Aerospace Engineering. It must have good literary form and style, and must give a thorough survey of prior literature in the subject. The candidate is required to take a final oral examination upon completion of the dissertation in defense of his research.

Aerospace Engineering

A.E.

215. **Experimental Fluid Dynamics II.** 3 hr. PR: A.E. 115. Continuation of A.E. 115 with increased emphasis on dynamic measurements. Shock tube, tunnel and subsonic and supersonic measurements. Experiments include optical techniques, heat transfer to models, and viscous flow measurements. Error analysis of test data. 2 hr. lec., 3 hr. lab.

216. **Applied Aerodynamics.** 3 hr. PR: A.E. 140. Chordwise and spanwise airload distribution for plain wings, wings with aerodynamic and geometric twist, wings with deflected flaps, and wings with ailerons deflected. Section induced drag characteristics. 3 hr. lec.
220. **Guided Missile Systems.** 3 hr. PR: A.E. 112 and/or consent; A.E. 150 Design philosophy according to mission requirements. Preliminary configuration and design concepts. Aerodynamic effects on missiles during launch and flight. Ballistic missile trajectories. Stability determination by analog simulation. Performance determination by digital and analog simulation. Control, guidance, and propulsion systems. Operational and reliability considerations. 3 hr. lec.
232. **V/STOL Aerodynamics.** 3 hr. PR: A.E. 112. An introductory course presenting the fundamental aerodynamics of V/STOL aircraft. The topics covered include propeller and rotor theory, helicopter performance, jet flaps, ducted fans and propeller-wing combinations. 3 hr. lec.
234. **Fluid Dynamics III.** 3 hr. PR: A.E. 112. Fundamentals of viscous flow and introduction of the Navier-Stokes equation; incompressible laminar flow in tubes and boundary layers; transition from laminar to turbulent flow; incompressible turbulent flow in tubes and boundary layers. 3 hr. lec.
235. **Fluid Dynamics IV.** 3 hr. PR: A.E. 112. One-dimensional, non-steady gasdynamics. Shock tube theory and applications. Fundamentals of supersonic and hypersonic flow and the determination of minimum drag bodies. 3 hr. lec.
242. **Flight Testing.** 3 hr. PR: A.E. 140. Applied flight test techniques and instrumentation, calibration methods, determination of static performance characteristics, and introduction to stability and control testing based on flight test of Cessna Super Skywagon airplane. Flight test data analysis and report preparation. 1 hr. lec., 6 hr. lab.
249. **Space Mechanics.** 3 hr. PR: Math. 18, T.A.M. 51. An introduction of flight in and beyond the earth's atmosphere by space vehicles. The laws of Kepler and Orbital theory. Energy requirements for satellite and interplanetary travel. Exit from and entry into an atmosphere. 3 hr. lec.
250. **Advanced Topics in Propulsion.** 3 hr. PR: A.E. 150 or consent. Special problems of thermodynamics and dynamics of aircraft power plants. Chemical rocket propellants and combustion. Rocket thrust chambers and nozzle heat transfer. Nuclear rockets. Electrical rocket propulsion. 3 hr. lec.
260. **Design of Flight Structures I.** 3 hr. PR: A.E. 161. Structural design and analysis of flight vehicle members. Layout and detail design of specified components are required. 1 hr. lec., 6 hr. lab.
265. **Aeroelasticity.** 3 hr. PR: A.E. 160. The study of vibrating systems of single degree and multiple degrees of freedom, flutter theory and modes of vibration, torsional divergence, and control reversal. 3 hr. lec.
280. **Aerospace Problems.** 1-6 hr. Upper division and graduate.
285. **Thesis.** 2-6 hr. PR: Senior standing and consent.
291. **Introduction to Research.** 1-3 hr. PR: Senior standing and consent. An introduction to the methods of organizing theoretical and experimental research. Formulation of problems, project planning, and research proposal preparation.

292. **Research Problems.** 2-6 hr. PR: A.E. 291 or consent. Performance of the research project as proposed in A.E. 291. Project results are given in written technical reports, with conclusions and recommendations.
300. **Seminar.** Credit. Attendance required of all graduate students at scheduled Aerospace Engineering seminars.
315. **Fluid Flow Measurements.** 3 hr. PR: A.E. 112 or consent. The principles and measurements of: static and dynamic pressures and temperatures, velocity and Mach number forces. Optical techniques and photography. Design of experiments. Review of selected papers from the literature. 2 hr. lec., 3 hr. lab.
380. **Special Problems.** 2-4 hr. PR: Consent of departmental chairman. A course for graduate students in the non-research program. The student will select a specialized field and follow a course of study in that field under the supervision of a counselor.
381. **Specialized Study Program.** 1-6 hr. PR: Consent. Discussion, individual study reports in the Aerospace Engineering field. Other topics may be included consistent with demand and changing requirements.
411. **Dynamics of Viscous Fluids.** 3 hr. PR: Consent. Exact solutions of the Navier-Stokes equations. Laminar incompressible and compressible boundary layer theory, similarity solutions and integral methods. 3 hr. lec.
412. **Fundamentals of Turbulent Flow.** 3 hr. PR: A.E. 411 or consent. Survey of the basic experimental data. Application of the semi-empirical theories to pipe, jet and boundary layer flow. Turbulent heat and mass transfer. Statistical theory of turbulence and recent applications. Hydrodynamic instability and its relation to transition. 3 hr. lec.
413. **Dynamics of Real Gases.** 3 hr. PR: A.E. 411 or consent. Fundamentals of multicomponent, chemically reacting, gas flows; thermodynamic properties of equilibrium mixtures from statistical mechanics; chemical kinetics; effects of the chemical model on high-temperature, high-speed flow properties.
425. **Perfect Fluid Theory.** 3 hr. PR: Consent. Conformal mapping including Schwarz-Christoffel and Joukowski transformations. Inviscid flows over airfoils, spheres, cones, wedges, and bodies of revolution. 3 hr. lec.
435. **Gas Dynamics I.** 3 hr. PR: A.E. 112 or consent. Nonsteady gas dynamics and shock tube theory. Applications of shock tubes in aerospace research. Compressible flow theory in the subsonic, transonic, and supersonic regimes. 3 hr. lec.
436. **Gas Dynamics II.** 3 hr. PR: A.E. 435 or consent. Transonic flow-hodograph method, the Chaplygin-Karman-Tsin approximation. Hypersonic flow-blunt-body field theory. Shock wave and viscous interaction with flow fields, blast-wave theory and similar solutions. High temperature and rarefied gasdynamic effects. 3 hr. lec.
440. **Advanced Flight Mechanics.** 3 hr. PR: A.E. 140, 112. Dynamic stability. Obtaining flight characteristics of the vehicle from dynamic flight test techniques, such as frequency response, and transient response methods. The problems of automatic control. 3 hr. lec.
449. **Space Mechanics.** 3 hr. PR: Math. 245, A.E. 112, 150. Variational formulation of mechanics. Theory of orbits and trajectories with applications to astronomical problems. Introduction to the space environment of the solar system. 3 hr. lec.

450. **Fundamentals of Combustion.** 3 hr. PR: A.E. 112 or consent. Fundamentals of kinetic theory, transport phenomena, chemical equilibrium and reaction kinetics. Flames, their gross properties, structure and gas dynamics. Solid and liquid propellant combustion. One dimensional detonation theory including structure and initiation. Supersonic burning. 3 hr. lec.
458. **Foundations of Magnetohydrodynamics I.** 3 hr. PR: Consent. Effects of ionization in gas flows; equations of state, charge, mass, momentum, and energy conservation; effects of self-generated and external electric and magnetic fields on electrically conducting fluids and transport coefficients. 3 hr. lec.
459. **Applied Magnetohydrodynamics II.** 3 hr. PR: A.E. 458 or consent. Incompressible and viscous MHD channel flow; plane waves in fluids, discontinuities and MHD shock waves; applications of MHD to electric power generation, etc. 3 hr. lec.
465. **Dynamics of Aerospace Structures I.** 3 hr. PR: A.E. 474 or consent. Free and forced vibrations of systems with finite and infinite degrees of freedom. Effect of rotary inertia and shear on lateral vibrations of beams. Role of Hamilton principle and Lagrange equations in vibration problems. Deformation of structure under static and dynamic loads; force and displacement matrix methods in vibration analysis. Methods of computing natural mode shapes and frequencies. 3 hr. lec.
466. **Dynamics of Aerospace Structures II.** 3 hr. PR: A.E. 465. Brief review of two and three-dimensional wing theory in incompressible and compressible flow. Wings and bodies in three-dimensional unsteady flow. Static aeroelastic phenomena. Flutter problems and dynamic response phenomena. 3 hr. lec.
474. **Advanced Aerospace Structures I.** 3 hr. PR: A.E. 161 or consent. The role of principle of virtual displacement in stress analysis; deflection of trusses and beams. Statically indeterminate problems (trusses, space framework, etc.). Hardy cross moment distribution and slope deflection methods. Matrix methods of structural analysis; force and displacement methods. 3 hr. lec.
475. **Advanced Aerospace Structures II.** 3 hr. PR: A.E. 474 or consent. Variational principles in structural analysis, beam-column, sandwich beams and plates. Methods of obtaining exact and approximate solutions (Raleigh-Ritz, Galerkin, etc.). Buckling loads of structures in compression. Stiffened panels, wrinkling in sandwich construction. Minimum weight design. Shells in aerospace structures. 3 hr. lec.
497. **Research.** 1-15 hr.

AGRICULTURAL ENGINEERING

(With Options in Forest Engineering)

Master of Science in Agricultural Engineering and Master of Science in Engineering programs are offered with areas of major emphasis in either Agricultural Engineering or Forest Engineering.

Before being admitted to graduate work in the Department of Agricultural Engineering, the prospective student must be admitted to the Graduate School. The student must comply with

the rules and regulations as outlined in the general requirements for graduate work in the College of Engineering.

Candidates with a B.S.Ag.E. from an accredited curriculum may enroll for the M.S.Ag.E. degree. Candidates holding a baccalaureate degree in other fields of engineering or the physical sciences may enroll for the M.S.E. degree. These students must remove all undergraduate requirements that are prerequisite to their graduate programs.

A student is admitted to candidacy for the M.S.Ag.E. or M.S.E. degree only by formal written application after he has completed at least 9 credit hours of graduate work at WVU with a grade-point average of at least 3.0.

The areas of concentration available with major emphasis in Agricultural Engineering are:

1. *Power and Machinery*—This area emphasizes design and development of machines and equipment for the agricultural industries. It includes the physical properties of plants and animals as they relate to machine and equipment development.

2. *Electric Power and Processing*—Includes the application of electricity to agriculture and processing of food and fiber from the producer to the consumer.

3. *Soil and Water Conservation*—Includes hydrology, drainage, erosion control and irrigation.

4. *Structures and Environment*—Design of structures, including the functional requirements for plants and animals. Waste disposal and utilization are included.

The areas of concentration available with major emphasis in Forest Engineering are:

1. *Power and Machinery*—Includes hydraulic power. This area emphasizes design and development of machines for the forest industries.

2. *Industrial*—This area emphasizes the system's approach and management of machines and equipment for the production and harvesting of forest products.

3. *Hydrology*—This area emphasizes the conservation of soil and water, and pollution control, in forest areas.

Thesis: A thesis is normally required of all candidates for the M.S.Ag.E. or the M.S.E. degree. In most cases, it will be necessary to take 6 hours of research, Agricultural Engineering 497 or Forest Engineering 497. A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The candidate may find that completion of the thesis for approval will delay his originally anticipated date of graduation. After satisfactory completion of his thesis, and course work, the candidate will be given an examination by his special committee.

Thesis Supervisor: Each student will be assigned a thesis supervisor who will serve as chairman of his graduate committee.

Agricultural Engineering

Ag. Eng.

- 201. **Agricultural Structures.** II. 3 hr. PR: T.A.M. 52. Structural design and functional requirements of agricultural buildings. 2 hr. rec., 3 hr. lab.
- 210. **Application of Electricity to Agriculture.** II. 3 hr. PR: E.E. 105. Economic application of electric light, heat, and power. 2 hr. rec., 3 hr. lab.
- 220. **Agricultural Process Engineering.** II. 3 hr. PR: C.E. 115, M.E. 101. Application of the fundamentals of engineering to agricultural engineering processes. 2 hr. rec., 3 hr. lab.
- 230. **Farm Power.** I. 3 hr. PR: M.E. 101. Fundamental theories underlying design and operation of internal combustion engines used in agriculture. 2 hr. rec., 3 hr. lab.
- 240. **Hydrology.** I. 3 hr. PR: C.E. 115. Study of a hydrologic cycle with emphasis on precipitation and runoff as related to design of hydraulic structures, soil and water conservation, and flood control. 3 hr. rec.
- 250. **Soil and Water Conservation.** I. 3 hr. PR: C.E. 115. Engineering principles and practices in conservation, utilization, and management of soil and water resources. 2 hr. rec., 3 hr. lab.
- 260. **Properties of Biological and Animal Materials.** II. 3 hr. PR: Biol. 1, T.A.M. 102, or consent. Study of physical properties of biological materials as related to harvesting, handling and transporting, conditioning, preserving and storing operations. 2 hr. rec., 3 hr. lab.
- 280. **Agricultural Engineering Problems.** 1-3 hr. PR: Consent. Special problems relating to agricultural engineering.
- 290. **Elements of Machinery Design.** II. 3 hr. PR: M.E. 101. Design requirements for construction, principles of operation and adequate adjustment of agricultural machines and principles of testing agricultural equipment. 2 hr. rec., 3 hr. lab.
- 300. **Seminar.** I. 1 hr. PR: Graduate standing.
- 340. **Problems in Hydrology.** I. 3 hr. PR: Ag. Eng. 240. Consideration of special problems in hydrograph analysis, hydrologic performance of small watersheds, erosion and sedimentation, hydro-meteorological studies, flood runoff and peak discharge, drought, river forecasting, frequency analysis of hydrologic data. Special report. 3 hr. rec.
- 341. **Physical Climatology.** II. 3 hr. PR: Consent. Physical principles underlying the variations and changes in climate, climatic controls, elements of micro climatology, engineering applications and uses of climatic data. 3 hr. rec.
- 420, 421. **Special Topics.** I, II, S. 1-6 hr. (For the Master's degree, Special Topics ordinarily may count 2 to 4 hr.; maximum credit, 6 hr.).
- 497. **Research.** I, II, S. 1-15 hr.

Forest Engineering

Forest Eng.

- 300. **Seminar.** I or II. 1 hr. Current discussion of research in forest engineering and special report.

391. **Logging Systems Engineering.** I. 3 hr. PR: Math. 18 or consent. Theory and design of modern forest harvesting systems such as balloon logging, cableways, pipelines and conveyors. Design features of specialized forest harvesting machines and devices. Systems engineering approach to equipment utilization. 3 rec.
392. **Hydraulic Power.** II. 3 hr. PR: Math. 18 or consent. Includes characteristics of hydraulic control components, hydraulic fluid characteristics, materials in hydraulic circuits, components and elements for circuit design, the feedback control approach, derivation of component transfer functions, measuring control dynamic characteristics, computer simulation techniques, hydraulic control circuits and hydraulic design practice. 3 rec.
420. **Advanced Independent Study.** I, II, S. 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of forest engineering.
497. **Research.** I, II, S. 1-15 hr.

CHEMICAL ENGINEERING

Master of Science in Chemical Engineering Master of Science in Engineering

Students must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering. The three types of master's degree programs, as outlined under College of Engineering Academic Standards and Curricula, are offered in all graduate programs administered by the Department of Chemical Engineering.

All M.S. Degree candidates must follow a planned program which conforms to one of the following outlines:

1. A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.
2. A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.
3. A minimum of 36 semester credit hours, with no thesis or problem report required.

Admission to the M.S.Ch.E. program is restricted to those holding a baccalaureate degree in chemical engineering or its equivalent. As an option of the M.S.Ch.E. curriculum, the Department offers a unique 36-hour non-thesis design oriented chemical engineering practice program for students desiring to terminate their formal education at the M.S. level.

The M.S.E. program is available to students holding baccalaureate degrees in chemical engineering, other fields of engineering, and the physical sciences who wish to pursue a broad interdisciplinary program relevant to the major graduate areas administered by the Department.

Courses. The adviser, in conjunction with an advisory and examining committee to be assigned to each student, will be re-

sponsible for following departmental guidelines to determine specific courses appropriate to the student's program. While there are no fixed chemical engineering course requirements, each student will be expected to both develop and demonstrate competence in at least two of the eight major areas offered by the Department. These areas include: (1) Chemical Engineering Practice, (2) Materials Engineering, (3) Mathematics and Systems, (4) Nuclear Engineering, (5) Process Chemistry, (6) Thermodynamics and Kinetics, (7) Transport Phenomena, (8) Unit Operations.

Examination. A candidate shall be required to pass examinations which may be written, or oral, or both, covering both course material and the thesis or problem report, depending upon the program selected.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering and Graduate School. A program with a major in Chemical Engineering, designed to meet the needs and objectives of each student, will be developed in consultation with the student's adviser and advisory and examining committee.

The research work for a doctoral dissertation should show a high order of originality on the part of the student and must offer an original contribution to the field of engineering science. It must have good literary form and style, and must give a thorough survey of the prior art with acceptable standards of documentation. Upon completion of the dissertation, the candidate will be required to submit to an oral defense. This examination will be designed to establish the candidate's logic, critical ability, and reasoning power, and will be based upon the field covered by the dissertation.

Chemical Engineering

Ch.E.

- 210. **Process Engineering.** 3 hr. PR: Ch.E. 111. Process equipment calculations for unsteady state. Determination of maximum and minimum process conditions. Economics of processing methods. 3 hr. rec.
- 224. **Process Development.** 3 hr. PR: Chem. 134, 144, Ch.E. 111 and 143. Development of process systems from the modified unit operations-unit process concept. Use of thermodynamics and kinetics in the evaluation of system requirements and performance. 3 hr. rec.
- 231. **Mathematical Methods in Chemical Engineering.** 3 hr. PR: Math. 18. The classification and solution of mathematical problems important in chemical engineering. Treatment and interpretation of engineering data. Analytical methods for ordinary and partial differential equations including orthogonal functions and integral transforms. 3 hr. rec.

238. **Design and Analysis of Experiments.** 3 hr. PR: Consent. Development of quantitative relationships of a system as a whole; the interpretation of these relationships through response surface analysis; factorial, composite, and screening designs; evolutionary operations; optimum conditions; and case histories. 3 hr. rec.
251. **Metallurgical Engineering.** 3 hr. PR: Physics 12. Includes: principles of production of metals and alloys, plastic deformation of metals, corrosion, and metal failure. 3 hr. rec.
253. **Ceramic Engineering I.** 3 hr. PR: Physics 12. Characterization of ceramic systems. Includes the study of internal structure and structure sensitive properties; liquid and solid solutions; rheology; mechanical, thermal, chemical, optical, and electrical properties. 3 hr. rec.
258. **Polymers and Polymer Technology.** 3 hr. PR: Chem. 134 or concurrent registration. Description of polymers and their handling. Properties of macromolecules as influenced by molecular weight, polymerization methods, plastics technology, polymer engineering. 3 hr. rec.
270. **Strategy of Process Engineering.** 3 hr. PR: Ch.E 111 or consent. The latest theories of process design and process optimization, proven through regular use by practicing engineers, are applied to the major problems of process engineering. 3 hr. rec.
280. **Chemical Engineering Problems.** 1-6 hr. For juniors, seniors, and graduate students. May be used to correct deficiencies preparatory to or following courses such as Ch.E. 170 and 171, or for students in other disciplines desiring to take only a portion of a course.
301. **Transport Phenomena.** 3 hr. PR or Conc: Ch.E. 231, or equiv. Introduction to the equations of change (heat, mass and momentum transfer) with a differential balance approach. Use in Newtonian flow, turbulent-flow, mass and energy transfer, radiation, convection. Estimation of transport coefficients. 3 hr. rec.
307. **Distillation.** 2-5 hr. PR: Math. 18 and consent. Study of vaporization principles of separation of liquid mixtures, steam, batch, continuous, azeotropic, extractive, and molecular distillation. 3 hr. rec., 0-6 hr. lab.
- 323, 324. **Advanced Process Development.** 3 hr. PR: Consent. Use of extended and generalized unit process and unit operation concepts; specialized synthetic methods; reaction mechanisms and their effects on equipment design and performance; study of properties, their evaluation, prediction and marketability; industrial toxicology and plant safety. 3 hr. rec.
330. **Process Dynamics and Control.** 3 hr. PR: Consent. Dynamic response of processes and control instruments. Use of Laplace transforms and frequency response methods in analysis of control systems. Application of control systems in chemical reactors, distillation, and heat transfer operations. Introduction to non-linear systems. 3 hr. rec.
344. **Thermodynamics.** 3 hr. PR: Consent. Emphasis is placed on the logical development of thermodynamic principles. These are applied to selected topics including development and application of the phase rule, physical and chemical equilibria in complex systems and non-ideal solutions. Introduction to non-equilibrium thermodynamics. 3 hr. rec.
345. **Chemical Reaction Engineering.** 3 hr. PR: Consent. Homogeneous reactions, batch and flow reactors, ideal reactors, macro and micro mixing, non-ideal flow reactors, heterogeneous reaction systems, catalytic and

- non-catalytic reactions, reactor stability analysis, reactor optimization. 3 hr. rec.
351. **Physical Metallurgy.** 3 hr. PR: Physics 12. Includes structure of metals, alloy diagrams, and principles of heat treating. 3 hr. rec.
 354. **Ceramic Engineering II.** PR or Conc: Ch.E. 253. Processing in ceramics systems. Includes the selection of ceramic raw materials and all steps required to produce a finished product; process control to develop uniformity, reliability, and reproducibility; correlations among ceramic systems. 3 hr. rec.
 355. **Ceramic Engineering Laboratory.** 3 hr. PR: Consent. Application of factorial design and response surface analysis for the development of quantitative relationships in ceramic systems. 1 hr. rec. and two 3-hr. lab. periods per week.
 358. **Polymer Processing.** 3 hr. PR: Chem. 134 or consent. Analytical description of rheology, molding, extrusion, bonding, polymer modification operations, physical properties. 3 hr. rec.
 370. **Process Equipment Design I.** 3 hr. PR: Ch.E. 301 or consent. Design, sizing, optimization, and cost estimation of equipment used for heat transfer, emphasis on design techniques, computer design techniques discussed where applicable.
 371. **Process Equipment Design II.** 3 hr. PR: Ch.E. 301 or consent. Design, sizing, optimization, and cost estimation of equipment used for mass transfer operations, emphasis on practical aspects of equipment design, computer design techniques discussed where applicable. 3 hr. rec.
 400. **Chemical Engineering Seminar.** 1-6 hr. Includes such topics as fluidization, bioengineering, transport phenomena for biological systems, air and water pollution abatement, fast-reaction kinetics, radiation and direct energy conversion. Other topics may be included consistent with demand and changing requirements.
 402. **Advanced Fluid Dynamics.** 3 hr. PR: Consent. An analysis of the flow of fluids and the transport of momentum and mechanical energy. The differential equations of fluid flow; potential flow, flow in porous media, laminar boundary layer theory, and non-Newtonian fluids. 3 hr. rec.
 404. **Advanced Heat Transfer.** 3 hr. PR: Consent. Theory of the transport of thermal energy in solids and fluids as well as radiative transfer. Steady and transient conduction; heat transfer to flowing fluids; evaporation; boiling and condensation; packed and fluid bed heat transfer. 3 hr. rec.
 406. **Advanced Mass Transfer.** 3 hr. PR: Consent. Theory of diffusion, interphase mass transfer theory, turbulent transport, simultaneous mass and heat transfer, mass transfer with chemical reaction, high mass transfer rates, multicomponent macroscopic balances. 3 hr. rec.
 432. **Optimization of Chemical Engineering Systems.** 3 hr. PR: Consent. Optimization in engineering design, unconstrained optimization and differential calculus, equality constraints optimization, search technique, maximum principles, geometric programming, dynamic programming, linear and non-linear programming, calculus of variations. Application to chemical reaction engineering problems will be stressed. 3 hr. rec.
 446. **Catalysis.** 3 hr. PR: Ch.E. 345 or consent. Physical and chemical properties of catalytic solids, nature and theories of absorption, thermodynamics of catalysis, theories of mass and energy transport, theoretical

and experimental reaction rates, reactor design and optimization. 3 hr. rec.

447. **Non-Catalytic Solid-Fluid Reactions.** 3 hr. PR: Ch.E. 345 or consent. Reaction models, pseudo-steady state approximation, effectiveness factor, transport and chemical reaction properties, geometric, thermal and transitional instabilities, simultaneous multiple reactions, selectivities in fixed, moving and fluidized bed reactor design. 3 hr. rec.
472. **Process Design and Development I.** 3 hr. PR: Ch.E. 301 or consent. Process development from inception to the final design, emphasis on economics and cost estimating at various stages of process development, relationship of research and development, engineering design and production, process optimization and computer design techniques. 3 hr. rec.
473. **Process Design and Development II.** 3 hr. PR: Ch.E. 472 or consent. Practice of process design using case studies method either with class or student teams, concurrent lectures on relevant subjects taught by specialists using team teaching concepts. 3 hr. rec.
480. **Advanced Independent Study.** 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of chemical engineering.
497. **Research.** 1-15 hr.

Nuclear Engineering

Nuc.E.

290. **Introduction to Nuclear Engineering.** 3 hr. PR: Junior standing. An introduction to the fundamental principles and applications of nuclear technology in science and engineering fields. Includes studies of nuclear fission and the design and operation of nuclear reactor systems; uses of radioisotopes as power sources and in materials processing, testing, and medicine; health physics and radiation detection and shielding.
390. **Nuclear Reactor Systems I.** 3 hr. PR: Consent. Intended as a first course for graduate students in the area of power reactor systems analysis and design. Includes topics such as neutron interactions with reactor materials, fission, reactor physics, reactor heat generation and removal, and thermal reactor core design.
391. **Nuclear Reactor Systems II.** 3 hr. PR: Nuc.E. 390. A continuation of Nuc.E. 390. Includes topics such as reactor kinetics, nuclear power economics, and case studies and analyses of the following reactor systems: pressurized-water, boiling-water, fast breeder, and gas-cooled power plants.
392. **Interaction of Radiation and Matter.** 1-3 hr. PR: Consent. Types of radiation, energy deposition by radiation, experimental instrumentation, formation and reactions of radiation-chemical species. 1-3 hr. rec.
393. **Nuclear Laboratory.** 1-3 hr. PR or Conc.: Nuc.E 390 or Nuc.E. 392, or equiv. Techniques of radiation measurements. Dosimetry. Determination of neutron and gamma interaction properties with materials. Analog nuclear reactor simulation. Experiments with swimming pool reactor, neutron generator, and cobalt-60 radiation facility.
400. **Nuclear Engineering Seminar.** 1-6 hr. PR: Consent. Includes such topics as the kinetics of boiling water reactors, breeder reactor concepts, fast reactor systems, pulsed reactor systems, radiation chemistry, and space nuclear power systems. Other topics may be included consistent with demand and changing requirements.

480. **Advanced Independent Study.** 1-6 hr. PR: Consent. Designed to increase the depth of study in a specialized area of nuclear engineering.
495. **Utilization of Radiation.** 3 hr. PR: Nuc.E. 392 or consent. Chemical and polymer processing with radiation, design of irradiation systems, instrumentation, process control. 3 hr. rec.
497. **Research.** 1-15 hr.

CIVIL ENGINEERING

Master of Science in Civil Engineering

Master of Science in Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering. Each candidate will, with the approval and at the discretion of his graduate committee, follow a planned program which must conform to one of the following outlines:

1. A minimum of 30 semester credit hours, not more than 6 of which are in research leading to an acceptable thesis.
2. A minimum of 33 semester credit hours, not more than 3 of which are in research leading to an acceptable problem report.
3. A minimum of 36 semester credit hours, with no thesis or problem report required.

Courses: No rigid curriculum is prescribed for the degrees of Master of Science in Civil Engineering and Master of Science in Engineering. Graduate level work in mathematics, mechanics or other appropriate areas of science is customary, however, at least 15 semester hours credit should normally be selected from graduate civil engineering courses.

Thesis or Problem Report: A thesis or problem report is normally required of all candidates. While required credit in research (C.E. 497) is devoted to the thesis or report preparation, the thesis or problem report is not automatically approved after the required number of semester hours of research work have been completed. The thesis or problem report must conform with the general requirements of the Graduate School and with any additional requirements established by the Department of Civil Engineering.

Final Examination: A candidate shall be required to pass an examination which may be written, oral, or both to be administered by his advisory and examining committee. The examination shall cover course material and the thesis or problem report, depending upon the program followed.

Master of Science in Civil Engineering

Approval for this degree is restricted to those holding a baccalaureate degree in civil engineering.

Master of Science in Engineering

The M.S.E. program is available to the students approved for the graduate program who do not possess a baccalaureate

degree in civil engineering. Students entering this graduate program must complete appropriate undergraduate work as specified by departmental regulations.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general requirements for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee.

The research work for the doctoral dissertation must show a high degree of originality on the part of the student and must constitute an original contribution to the art and science of civil engineering. The dissertation must have good literary form and style and must present a thorough review of the prior study in the subject with acceptable standards of documentation. The candidate is required to take a final oral examination upon completion of the dissertation. This examination is designed to permit the candidate to demonstrate his ability to present and defend his work orally in a logical manner.

Civil Engineering

C.E.

- 212. **Concrete and Aggregates.** 3 hr. PR: C.E. 110. Considerations and methods for the design of concrete mixes. Effect of air entraining agents and other additives. Studies of the influence of aggregate properties on the design and performance of concrete mixtures. An analysis of the methods of testing commonly used for concrete and aggregates and the significance of these tests. 2 hr. rec., 3 hr. lab.
- 213. **Construction Methods.** 3 hr. PR: C.E. 110 and 180. The study of construction methods, equipment, and administration with particular emphasis on the influence of new developments in technology. 2 hr. rec., 3 hr. lab.
- 222. **Open Channel Flow.** 3 hr. PR: C.E. 120. An analysis of the hydraulic problems associated with natural waterways, man-made waterways, and the design of the hydraulic structures of open channels. 3 hr. rec.
- 232. **Principles of Transportation Engineering.** 3 hr. PR: C.E. 131 or consent. A basic approach to the problem of integrated transportation systems from the standpoint of assembly, haul, and distribution means. Analysis of the characteristics of the transport equipment and traveled way. Power requirements, speed, stopping, capacity, costs, economics of location and route selection will be discussed. Future technological developments and innovations will be considered. 3 hr. rec.
- 235. **Railway Engineering.** 3 hr. PR: C.E. 101. Development and importance of the railroad industry. Principles of location, construction, operation, and maintenance. 3 hr. rec.
- 251. **Public Health Engineering.** 3 hr. PR: C.E. 146 or 147 or consent. The engineering aspects involved in the control of the environment for the

protection of the health and the promotion of the comfort of man. Discussions will include communicable disease control, milk and food sanitation, air pollution, refuse disposal, industrial hygiene, and radiological health hazards. 3 hr. rec.

252. **Water Resources Engineering.** 3 hr. PR: C.E. 120. The design of water-resource systems. The interrelationship between economic objectives, engineering analysis, and governmental agencies. 3 hr. rec.
260. **Structural Analysis II.** 3 hr. PR: C.E. 160. An introduction to the fundamental theory of statically indeterminate structures. General theory of continuity and iterative and energy methods applied to the analysis of indeterminate beams and frames. 3 hr. rec.
270. **Structural Design I.** 3 hr. PR or conc: C.E. 169. Theory and design of reinforced concrete members. Design considerations for concrete bridges and buildings. 2 hr. rec., 3 hr. lab.
271. **Structural Design II.** 3 hr. PR or conc: C.E. 169. Design of steel bridge and building structures. Welded, riveted, and bolted connections; simple and moment-resistant connections; cost estimates. 2 hr. rec., 3 hr. lab.
281. **Foundations Engineering.** 3 hr. PR: C.E. 180. Soils exploration and the design and analysis of engineering foundations. Particular emphasis on earth pressures and the design of retaining walls, studies of bracing systems and the elements of shallow and deep foundations for bridges and buildings. Movement of water through soil structures and control of water in excavations. 3 hr. rec.
291. **Comprehensive Projects for Civil Engineering.** 3 hr. PR: Senior standing or consent. The application of civil engineering principles, through group studies, to develop a solution for a comprehensive engineering problem. Consideration will be given to a problem involving all aspects of civil engineering. 2 hr. rec., 3 hr. lab.
307. **Photogrammetry.** 3 hr. PR: C.E. 101. Geometry and interpretation of the aerial photograph; flight planning; radial-line control; principles of stereoscopy; plotting instruments. 2 hr. rec., 3 hr. lab.
308. **Geodesy.** 3 hr. PR: C.E. 101. Precise base line measurements, triangulation and leveling, geodetic astronomy; figure of the earth, map projections; rectangular coordinate systems; least squares adjustments; gravity. 3 hr. rec.
310. **Bituminous Materials and Mixtures.** 3 hr. PR: C.E. 110. Manufacture and testing of bituminous materials. Significance of tests and specifications of bituminous materials. Principles of the design of bituminous mixtures, including methods of test and the influence of aggregate, temperature, and other variables upon design for stability and durability. Production of bituminous mixtures and construction practice in utilizing these mixtures. 2 hr. rec., 3 hr. lab.
311. **Pavement Design.** 3 hr. PR: C.E. 131, 180. Effects of traffic, soil, and loads on the design of pavement. Consideration of drainage and climate. Design of bases and sub-bases. Methods of design of flexible and rigid pavements. Performance of pavement surveys. 2 hr. rec., 3 hr. lab.
332. **Airport Planning and Design.** 3 hr. PR: C.E. 131 or consent. Airport financing, air travel demand modeling, aircraft trends, air traffic control, site selection, ground access, noise control, geometric design, pavement design, and terminal facilities. 3 hr. rec.

333. **Geometric Design of Highways.** 3 hr. PR: Consent. The theory and practice of the geometric design of modern highways. Horizontal and vertical alignment, cross-slope, design speed, sight distances, interchanges, and intersections are discussed. Critical analysis of design specifications. 2 hr. rec., 3 hr. lab.
334. **Introduction to Traffic Engineering.** 3 hr. PR: C.E. 131. This course will provide instruction in the purpose, scope, and methods of traffic engineering. Emphasis will be placed upon the three basic elements of the transportation system, i.e. the human, the vehicle, and the roadway. The characteristics of each element and interactions between the elements will be studied. The laboratory will be devoted to conducting simple traffic studies, solving practical problems, and designing traffic facilities. 2 hr. rec., 3 hr. lab.
345. **Properties of Air Pollutants.** 3 hr. PR: Consent. Physical, chemical, biological, and social behavioral properties of dusts, droplets, and gases in the atmosphere. Air pollutant sampling and analysis. The planning and operation of air pollution surveys. 2 hr. rec., 3 hr. lab.
349. **Solid Waste Disposal.** 3 hr. PR: Consent. Study of traditional patterns and problems of solid waste storage, transport, and disposal. Examination of various engineering alternatives with appropriate consideration for air pollution control, water pollution control, and land reclamation. Analytical approaches to recovery and reuse of materials. 2 hr. rec., 3 hr. lab.
350. **Sanitary Chemistry and Biology.** 3 hr. PR: C.E. 147 or consent. Study of the physical and chemical properties of water. Theory and methods of chemical analysis of water, sewage, and industrial wastes. Biological aspects of stream pollution problems. 2 hr. rec., 3 hr. lab.
356. **Principles of Biological Waste Treatment.** 3 hr. PR: C.E. 350 or consent. Examination of biological systems used in waste treatment as to ecology and function. Models used to describe system behavior are developed. Laboratory experiments are performed to understand operation and design of treatment plants. 2 hr. rec., 3 hr. lab.
359. **Basic Radiological Health.** 3 hr. PR: Consent. Fundamental theory and terminology. Environmental and occupational hazards in the nuclear field. Radioactive waste disposal. Laboratory measurements of radio activity. 2 hr. rec., 3 hr. lab.
361. **Statically Indeterminate Structures.** 3 hr. PR: C.E. 260. Advanced topics in indeterminate structural analysis for trusses and nonprismatic members. 3 hr. rec.
363. **Introduction to Structural Dynamics.** 3 hr. PR: Math. 18 and C.E. 361 or 460. General theory for dynamic response of systems having one or several degrees of freedom. Emphasis on the application of dynamic response theory to structural design. 3 hr. rec.
372. **Plastic Design of Steel Structures.** 3 hr. PR: C.E. 260, 271 or consent. The fundamental concepts of the plasticity of steel. Analysis of structures for ultimate load. The influence of axial forces, shear forces, and local buckling on the plastic moment. Study of structural connections and deflections. Steel structure design. 3 hr. rec.
373. **Prestressed Concrete.** 3 hr. PR: C.E. 270. The analysis and design of determinate and indeterminate prestressed beams and frames. 3 hr. rec.

374. **Timber Design.** 3 hr. PR: C.E. 160 and Wood Sci. 261 or consent. Emphasis on the fundamentals of modern timber design and analysis. Topics to be presented include a review of wood properties, the design of beams, columns, arches, trusses, and pole structures using dimensional lumber, glue-laminated and plywood components. Detailed study of connections using nails, shear connectors, and adhesives. 3 hr. rec.
375. **Reinforced Concrete.** 3 hr. PR: C.E. 160, 270. Theory and design of slabs, beams, columns, footings, retaining walls, and concrete buildings, with emphasis on ultimate load design. 2 hr. rec., 3 hr. lab.
380. **Soil Properties and Behavior.** 3 hr. PR: C.E. 180 or consent. A study of soil mineralogy and the physico-chemical properties of soils and their application to an understanding of the behavior of soils. Included is a detailed review of the basic and classical theories of permeability, consolidation, shear strength, and compaction. The prediction of the engineering behavior of soils is viewed in light of physico-chemical concepts. 3 hr. rec.
381. **Soil Testing.** 3 hr. PR: C.E. 180 or consent. Designed to complement and expand the material covered in C.E. 380 from an experimental standpoint. Experimental studies will be conducted to demonstrate empirical and theoretical principles. Emphasis will be placed on the proper interpretation of experimental results and the application of such results to practical problems. 1 hr. rec., 6 hr. lab.
421. **Hydraulic Structures.** 3 hr. PR: C.E. 120 or consent. The hydraulic analysis and design of engineering structures such as reservoirs, dams, spillways, gates, and outlet works. The study of hydraulic machinery, irrigation, hydroelectric power, drainage and flood control. 3 hr. rec.
422. **Surface and Subsurface Drainage.** 3 hr. PR: Consent. The study of the nature and requirements of drainage studies and drainage design as they pertain to transportation facilities. Emphasis is on the theory of drainage design and a critical analysis of drainage practices. 3 hr. rec.
430. **Highway Laws.** 3 hr. PR: Consent. The analysis of existing highway laws with emphasis on those aspects particularly related to planning functions such as reservation of right-of-way, access control, eminent domain, systems classification, and the basis for the existence and operation of various planning agencies. 3 hr. rec.
431. **Traffic Flow Theory.** 3 hr. PR: I.E. 213 and C.E. 438 or consent. An introduction to the basic concepts of quantitative analysis of traffic systems. Topics include probability theory, queuing theory, pedestrian and traffic delay at traffic signals, turning at intersections, parking problems, merging traffic on two lane roads, simulation of traffic problems. 3 hr. rec. (Also listed as I.E. 431.)
432. **Highway Economics and Administration.** 3 hr. PR: Consent. Study of the methods of financing highways, including federal participation. Consideration of the means of establishing allocation of highway cost and determination of economic justification of routes. Analysis of highway administrative organizations. 3 hr. rec.
434. **Urban Problems.** 3 hr. PR: Consent. The study of the particular problems of transportation in the urban area as they relate to the general development of the city. Emphasis is on the role of the engineer in the planning for urban transportation and the relationship of the engineer to the city planner and to the city administration. 3 hr. rec.

436. **Highway Planning I.** 3 hr. PR: Consent. Analysis of planning programs and methods including highway needs studies, priority rating systems, and programming methods. Consideration of traffic assignment and forecasting techniques. Devoted primarily to rural route problems. Case history method of study utilized. 3 hr. rec.
437. **Highway Planning II.** 3 hr. PR: C.E. 436. Continuation of C.E. 436 with special attention to urban locations and planning. 3 hr. rec.
438. **Traffic Engineering Characteristics.** 3 hr. PR: C.E. 131 or consent. The analysis of the basic characteristics of drivers, vehicles, and roadway that affect the performance of road systems. Studies of volumes, speeds, delays, intersections, interchanges, capacity, and accidents will be considered. The techniques of traffic engineering measurements, investigations, and data analysis, including laboratory practice, will be included. 2 hr. rec., 3 hr. lab.
439. **Traffic Engineering Operations.** 3 hr. PR: C.E. 438. The theory and practice of the application of traffic engineering regulations, traffic flow theory, the design and use of traffic control devices and signal systems. Traffic administration and parking control will be discussed. 3 hr. rec.
446. **Air Pollution Control Engineering.** 3 hr. PR: C.E. 345 or consent. Study of the engineering alternatives in achieving various degrees of air pollution control. Factors that are considered in selection and specification of dust and gas collectors and convertors for various types of operations, and the use of alternate process methods and process materials. 2 hr. rec., 3 hr. lab.
447. **Air Pollution Control Standards.** 3 hr. PR: C.E. 446 or consent. Comparative study of technical, economical, and social factors used in developing and establishing air pollution standards, criteria, and control limitations. Relationships between process design specifications, pollutant emission limitations, ambient air pollution effects on people and objects, air quality standards and emission performance limitations. 2 hr. rec., 3 hr. lab.
448. **Air Pollution Control Programs.** 3 hr. PR: C.E. 446 or consent. Examination of air pollution control programs of industries and government. Rationales and patterns of organization structure and operating administrative factors, including intra-office and inter-office and other group relationships. Significance of relationship with land use planning, solid waste, fire prevention, water pollution control, building inspection, and economic development agencies. 3 hr. rec.
452. **Water Treatment Theory.** 3 hr. PR: C.E. 350. Theory of the various procedures and techniques utilized in the treatment of water for municipal and industrial use. Review of water quality criteria. Design of water purification facilities. 2 hr. rec., 3 hr. lab.
454. **Industrial and Advanced Waste Treatment.** 3 hr. PR or conc: C.E. 350 or consent. An introduction to the basic physical and chemical operations used in industrial and advanced waste treatment; applications for wastewater reclamation and reuse; study of industrial wastes from the standpoint of process, source, and treatment. 3 hr. rec.
455. **Municipal and Industrial Design of Solid Wastes Disposal Operations.** 3 hr. PR: C.E. 349 or consent. Study of design criteria of existing methods and equipment for the disposal of solid wastes generated by industry and municipalities: on site preparation; volume and density modification; and reclamation of marketable materials. Process, source, treat-

ment, and final disposal with considerations of waste reclamation and reuse of available energy. 3 hr. rec.

457. **Hydraulics of Sanitary Engineering Works.** 3 hr. PR: C.E. 120. The application of the techniques of population growth estimation, rainfall and runoff analysis, food flow, and ground water data to the design of sanitary works. Design of water distribution systems and sewerage systems. 2 hr. rec., 3 hr. lab.
458. **Design of Sanitary Works.** 3 hr. PR: C.E. 120. The investigation of water supply and waste water disposal problems. The design of waste water treatment facilities. 2 hr. rec., 3 hr. lab.
460. **Statically Indeterminate Structures.** 3 hr. PR: C.E. 260 or consent. General theory of continuity, iterative, and classical methods of analysis of skeletal structures with emphasis on the influence coefficient method. 3 hr. rec.
461. **Bridge Engineering.** 3 hr. PR: C.E. 361 or consent. Statically indeterminate trusses, continuous trusses; steel and concrete arches; long-span and suspension bridges; secondary stresses. 3 hr. rec.
462. **Numerical Methods of Structural Analysis.** 3 hr. PR: C.E. 361 or 460. Methods of successive approximations and numerical procedures for the solution of structural problems. Application of these procedures to the analysis of bridges and buildings. 3 hr. rec.
471. **Light Gage Metal Design.** 3 hr. PR: C.E. 260, C.E. 271, or consent. Analysis and design of light gage metal systems; flexural and compression member design; investigations into post buckling strength and optimum weight systems. 3 hr. rec.
473. **Structural Design for Dynamic Loads.** 3 hr. PR: C.E. 363 or consent. Nature of dynamic loading caused by earthquakes and nuclear weapon blasts; nature of dynamic resistance of structural elements and structural systems; criteria for the design of blast-resistant structures; criteria for the design of earthquake-resistant structures; simplified and approximate design methods. 3 hr. rec.
474. **Behavior and Advanced Design of Timber Structures.** 3 hr. PR: C.E. 260, C.E. 374, Wood Sci. 261 or consent. A study of the behavior and analysis of structural systems and components fabricated from timber. Topics include the behavior of timber members subjected to bending, shear, and compression, impact, and vibration. An evaluation of the time dependent characteristics of timber members under load. The analysis and design of special timber structures including lamella roofs, stressed skin and prestressed members, and space frames. 3 hr. rec.
475. **Analysis and Design of Multistory Structures.** 3-6 hr. PR: C.E. 270 and C.E. 271. Theories of action of beams, slabs, and columns of reinforced concrete or steel; review of standard codes and specifications and their influence on design. 3 hr. rec.
476. **Behavior of Reinforced Concrete Members.** 3 hr. PR: C.E. 270 or consent. Studies of the actual behavior and strength of reinforced concrete members by critically reviewing experimental and analytical investigations. Beams subjected to pure flexure; columns subjected to axial compression; combined flexure and compression; combined flexure, shear, and bond. 3 hr. rec.

477. **Behavior of Reinforced Concrete Structures.** 3 hr. PR: C.E. 476. Continuation of C.E. 476. Studies of behavior and strength of statically indeterminate reinforced concrete structures. Comparison with reinforced concrete codes and specifications. 3 hr. rec.
478. **Thin Shell Roof Structures I.** 3 hr. PR: Math. 113, C.E. 361 or consent. Emphasis on the development and solution of the fundamental elastic equations for barrel vault roofs using matrix algebra. Study of the effects of edge members upon the strength and stiffness of barrel vault roofs. Design of simple shell structures. 3 hr. rec.
479. **Thin Shell Roof Structures II.** 3 hr. PR: C.E. 478 or consent. A continuation of C.E. 478. Analysis of multiple cylindrical shells using the theory of elasticity and matrix algebra. Ultimate load and variational methods in shell analysis. Design and analysis of doubly curved shells. 3 hr. rec.
480. **Geotechnic.** 3 hr. PR: Consent. A presentation of a unified approach to the various aspects of soil formation and the influence of the formative factors on the nature of soils and their use as engineering materials. Presented cooperatively with the Department of Agronomy and the Department of Geology. 3 hr. rec.
482. **Foundations Engineering.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of shallow and deep foundations. Detailed attention is given to methods of subsurface exploration, spread footings and mats, pile foundations, retaining walls, sheet pile structures and braced cofferdams. Particular emphasis is given to economy and performance in the selection of foundation treatment. 3 hr. rec.
483. **Earthwork Design.** 3 hr. PR: C.E. 380 or consent. Application of the principles of theoretical soil mechanics to the design of embankments of earth and rock. Detailed attention is given to compaction methods and equipment, the stability of natural and man-made slopes, embankment foundation stability and the design of earth and rockfill dams. 3 hr. rec.
484. **Groundwater and Seepage.** 3 hr. PR: Consent. The flow of groundwater through soils and its application to the design of highways and dams and to construction operations. Particular emphasis is placed on the analytical solution of seepage problems. The classical flow net techniques for solving seepage problems are also given detailed consideration. 3 hr. rec.
485. **Airphoto Interpretation.** 3 hr. PR: Graduate standing. A study of airphoto interpretation techniques to obtain qualitative information concerning the extent, type, and engineering characteristics of surficial materials. Emphasis will be placed on the use of airphoto interpretation for the location of construction materials and the evaluation of engineering problems associated with the different materials that are encountered in the design and location of engineering facilities.
486. **Soil Dynamics.** 3 hr. PR: C.E. 380 and consent. The fundamental behavior of soils subjected to dynamic loads produced by explosion effects, earthquake effects, and foundation vibrations. Particular emphasis is placed on the stress-strain-time behavior of soils for conditions of rapid stress or strain change. Consideration is given to wave propagation resulting from ground motions. The theories of vibration of a mass resting on an elastic half-space are applied to foundations vibration problems. 3 hr. rec.

490. **Advanced Design Problems.** 2-6 hr. A design or investigation of any assigned problem related to civil engineering.
495. **Seminar.** 1-2 hr. PR: Consent. Studies and group discussion of structural, fluid mechanics, surveying, transportation, soil mechanics and foundations, and sanitary problems.
497. **Research.** 1-15 hr.

ELECTRICAL ENGINEERING

Master of Science in Electrical Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

Course Requirements. All M.S.E.E. candidates will be required to meet the following minimum requirements:

	<i>Credit</i>
1. E.E. 325—Advanced Linear Circuit Analysis	3 hr.
2. Selected courses offered outside the Electrical Engineering Department to provide analytical techniques supporting the student's graduate program. (For example: Mathematics, Statistics, etc.) ...	6 hr. (min.)
3. Electrical Engineering Courses in the 300 or 400 level (other than E.E. 497)	9 hr. (min.)

Each M.S.E.E. candidate will be required to make an oral presentation of his thesis or problem research to a graduate seminar which will be given near the conclusion of his research but before scheduling his final examination.

Students with deficiencies in their undergraduate program may be required to take some electrical engineering or mathematics courses as prerequisites for graduate courses. These deficiencies are usually noted as a condition for admission. However, they may also be specified as a result of the qualifying examination. If these courses are normally required for the B.S.E.E. at WVU, they will not be accepted for credit in a master's degree program without approval of the student's Advisory and Examining Committee.

Qualifying Examination. All students beginning graduate study in electrical engineering will be given a qualifying examination. The purpose of the examination is to determine if a student is adequately prepared to pursue the master's degree program and to aid the faculty in advising the student. As a result of the examination, the student and his committee should prepare a mutually acceptable preliminary plan of study.

Final Examination. Each candidate for the master's degree shall pass a final examination administered by his Advisory and Examining Committee. This examination may be written or oral or both and shall cover the course materials and defense of the thesis or report when applicable.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with all requirements of the Graduate School and with the rules and regulations as outlined in "A Guide to the Graduate Program in Engineering" for graduate work in the College of Engineering. A program designed to meet the needs and objectives of each student will be developed in consultation with the student's committee. In addition, the following will be required by the department:

1. In general, requirements for the M.S.E.E. degree must be fulfilled. These requirements are outlined above.

2. A Ph.D. degree candidate will normally be required to take a minimum of six hours outside his major field. A minimum of three of these hours must be at the 300-400 level.

Thesis. Normally a thesis is required of all candidates for the degree of Master of Science in Electrical Engineering. Approval by the Advisory and Examining Committee is necessary before the thesis will be accepted. The thesis must be presented in a form that conforms to general requirements of the Graduate School, and in addition should conform to additional thesis requirements of the department.

Electrical Engineering

E.E.

200.* **Seminar.** (Credit). PR: Senior standing. Special material and projects.

201.* **Electronics for Scientists.** 3 hr. PR: General Physics and Calculus or consent. A special course for chemists, physicists, medical researchers and other research workers having a limited background in electronics. The material covered will begin with electrical and electronic fundamentals and leads systematically into servomechanisms, operational amplifiers, digital circuits, and other devices used in current laboratory research and control problems. (Not open to Engineering students.) 1 hr. rec., 6 hr. lab.

216. **Fundamentals of Control Systems.** 3 hr. PR: E.E. 127. Fundamental concepts of feedback control system analysis, stability, and design in the frequency, complex variable, and time domains. Includes Nyquist, root locus and state variable concepts, Mitrovic's method and Chen's method. 3 hr. rec.

218.* **Engineering Analysis and Design.** 3 hr. PR: E.E. 132, 153. Formulation and application of the method of engineering analysis based upon fundamental physical laws, mathematics, and practical engineering considerations. Emphasis is placed on the professional approach to the analysis of engineering problems. 3 hr. rec.

228. **Networks and Filters.** 3 hr. PR: E.E. 127 or consent. Analysis and synthesis of networks and filters. 3 hr. rec.

*Courses indicated will not apply for credit toward a graduate degree in Electrical Engineering.

230. **Symmetrical Components.** 3 hr. PR: E.E. 141 or consent. Analysis of polyphase systems in unbalanced and transient conditions. 3 hr. rec.
231. **Electrical Power Systems.** 3 hr. PR: E.E. 141 or consent. Analysis of balanced polyphase systems, including transmission lines. Polyphase transformation. 3 hr. rec.
234. **Electric Power Transmission and Distribution.** 3 hr. PR: E.E. 141. Circle diagrams applied to the various problems of power transmission; phase modifier applications and an introduction to power stability. 3 hr. rec.
235. **Electrical Machinery I.** 3 hr. PR: E.E. 133 or consent. Energy state functions; Lagrange's equation; dynamic equations of motion of electro-mechanical systems; generalized magnetic field type, rotating, electro-mechanical energy converter; two phase transformations; dynamics of commutator machines; induction machines and synchronous machines. 2 hr. rec., 3 hr. lab.
236. **Electrical Machinery II.** 3 hr. PR: E.E. 133 or consent. Electromagnetic fields in electrical devices; selected topics on induction motors; selected topics in transformer engineering, including surge phenomena; insulation of electrical equipment; winding of A.C. and D.C. machines. 2 hr. rec., 3 hr. lab.
244. **Introduction to Antennas and Radiating Systems.** 3 hr. PR: E.E. 141 or consent. Radiation from current distributions, linear antennas, far field approximations, field equivalence theorems, aperture antennas, antenna arrays, antenna patterns, antenna gain, and application to specific antenna types. 3 hr. rec.
245. **Microwave Circuits and Devices.** 3 hr. PR: E.E. 141. UHF transmission line theory, impedance matching techniques, impedance charts, general circuit theory of one port and multiports for waveguiding systems, impedance and scattering matrices, waveguide circuit elements, microwave energy sources. Course will be supplemented by laboratory problems. 3 hr. rec.
- 252.* **Electronics III.** 3 hr. PR: E.E. 153. Analysis of demodulation systems, waveshaping circuits, electronic power-handling systems, photo-sensitive devices, and microwave devices. 2 hr. rec., 3 hr. lab.
253. **Physical Electronics.** 3 hr. PR: E.E. 152. A study of the physical principles of electrical conduction and the application of these principles to electronic conduction in vacuum, gases and solids. Properties of semiconductors, junction diodes and transistors, field-effect transistors. 3 hr. rec.
257. **Transistor Circuits.** 3 hr. PR: E.E. 153 or consent. Application of the basic principles of semiconductor electronics to junction and field-effect devices. Development of equivalent circuits for junction diodes, transistors and field-effect transistors. 3 hr. rec.
264. **Introduction to Communications Systems.** 3 hr. PR: E.E. 125. Introduction to the first principles of communication system design. Analysis and comparison of standard analog and pulse modulation techniques relative to bandwidth, noise, threshold, and hardware constraints are emphasized. Communication systems are treated as opposed to individual circuits and components of the system. 3 hr. rec.
271. **Theory of Digital Computers.** 3 hr. PR: Senior and graduate students in Engineering, Mathematics, Physics, or Statistics. An introduction to the field of digital computer design. Topics include general computer

- organization, number systems and number representations, Boolean algebra and its application to computer design, and the characteristics of the major parts of a computing system. 3 hr. rec.
275. **Pulse Techniques.** 3 hr. PR: E.E. 127, 152. An introduction to the response of electrical networks to non-sinusoidal inputs, the analysis of active networks with large signals and the circuits and techniques used in pulse and digital equipment. Students will use the University's computing facilities by solving problems using ECAP. No previous programming is needed. 3 hr. rec.
 278. **Analogue Computers.** 3 hr. PR: Math. 18. A study of the theory and operation of analogue computers. Amplitude scaling and time scaling on the analogue computer and application of the analogue computer to the solution of differential equations. 3 hr. rec.
 - 280.* **Electrical Problems I.** 1-3 hr. For junior, senior, and graduate students.
 312. **Feedback System Theory.** 3 hr. PR: E.E. 216, 325. Signal flow graphs; sensitivity; return difference; mathematical definition of feedback; effects of feedback; multiple loop systems; multivariate systems. 3 hr. rec.
 315. **State Variable Analysis of Systems.** 3 hr. PR: Consent. Matrix theory and linear transformations as applied to linear control systems. The state-space on time-domain study of stability, controllability, observability, etc. 3 hr. rec.
 316. **Synthesis of Feedback Systems I.** 3 hr. PR: E.E. 312, 364. Methods of direct synthesis and optimization of feedback systems; Wiener theory; Pontryagin's maximum principle; dynamic programming; adaptive feedback systems. 3 hr. rec.
 325. **Advanced Linear Circuit Analysis.** 3 hr. PR: Consent. Systematic formulation of circuit equations. The use of operational techniques to find total solutions. Applications and characteristics of the Laplace and Fourier Transforms, Matrix algebra, complex variable theory and state variables are made to circuit analysis and elementary circuit synthesis. 3 hr. rec.
 328. **Modern Network Synthesis.** 3 hr. PR: E.E. 325 or consent. Two-terminal network synthesis; Brune and Bott-Duffin syntheses; four-terminal networks; modern filter synthesis; Darlington synthesis, transfer-function synthesis; ladder and lattice syntheses; potential analogy and approximation problems. 3 hr. rec.
 330. **Electrical Machinery III.** 3 hr. PR: E.E. 133 and E.E. 235, or consent. Mathematical description of a synchronous machine; steady-state, balanced synchronous operation; three-phase short-circuit analysis; single-phase short-circuit analysis; double-line-to-ground short circuit and sequential faults; short-circuit torques; starting torque; voltage dip, synchronizing phenomena and sustained oscillations. 3 hr. rec.
 331. **Electrical Power Systems.** 3 hr. PR: E.E. 231 or consent. Transient and steady-state stability of systems. Traveling waves on transmission lines; lightning and switching surges. The principles of the application of analog and digital computers to solution of power system problems. 3 hr. rec.
 333. **Application of Digital Computers to Power System Analysis.** 3 hr. PR: E.E. 231 or consent. Incidence and network matrices; algorithms for their formation; three-phase networks; short-circuit calculations; load-flow studies; transient stability. 3 hr. rec.

340. **Electromagnetic Fields and Guided Waves I.** 3 hr. PR: Consent. Solutions of Laplace's equation as applied to static fields; the application of Maxwell's equations to guided wave and antenna problems. 3 hr. rec.
341. **Electromagnetic Fields and Guided Waves II.** 3 hr. PR: E.E. 340. Transverse electromagnetic waves; propagation in cylindrical waveguides; in homogeneously filled waveguides; waveguide discontinuities. 3 hr.
350. **Electronic Circuits.** 3 hr. PR: E.E. 252. An advanced study for the analysis and design of electronic circuits; low-pass and band-pass amplifiers, single-tuned and double-tuned stages; equal ripple and maximally flat responses. 3 hr. rec.
353. **Physical Electronics II.** 3 hr. PR: E.E. 253 and E.E. 257, or consent. A study of semiconductor surfaces; surface states, space charge and the field effect. 3 hr. rec.
357. **Linear Integrated Circuits.** 3 hr. PR: E.E. 257. An introduction to techniques of integrated circuit design and fabrication. Development of models descriptive of linear and nonlinear transistor operation. Design and analysis of high-frequency tuned, dc, and differential amplifiers. Primarily for students specializing in communication and electronics. 3 hr. rec.
358. **Integrated Logic Circuits.** 3 hr. PR: E.E. 257 or consent. An introduction to techniques of integrated circuit design and fabrication. Development of transistor model for nonlinear operation. The design, analysis, and comparison of emitter-coupled, direct-coupled, diode-transistor, and transistor-transistor integrated logic circuits. Intended for students specializing in digital circuits. 3 hr. rec.
364. **Communication Theory.** 3 hr. PR: E.E. 264 or consent. Detailed study of probability theory and its use in describing random variables and stochastic processes. Emphasis is placed on applications to problems in communication system design. 3 hr. rec.
366. **Information Theory I.** 3 hr. PR: E.E. 364. Probability concepts; theory of discrete systems; encoding; theory of continuous systems; systems with memory; the fundamental theorem of information theory. 3 hr. rec.
370. **Switching Circuit Theory I.** 3 hr. PR: E.E. 271 or equiv. This course presumes an understanding of the elements of a Boolean or switching algebra. This is a study of both combinational and sequential switching circuits with emphasis on sequential networks. Advanced manual design and computer-aided-design techniques for single and multiple output combinational circuits are covered initially. Then the analysis and design of sequential circuits are considered. Finally, the detection and prevention of undesired transient outputs are studied. 3 hr. rec.
373. **Design of Computer Arithmetic Circuits I.** 3 hr. PR: E.E. 271 or equiv. A detailed study of computer circuitry usable in performing binary arithmetic. This course deals with the logic, circuitry, and engineering aspects of digital computer equipment design. Primary emphasis is placed on the design of high speed, parallel arithmetic units using the natural binary number system. Analysis of systems for representing negative numbers. A study of various means for obtaining high speed addition, subtraction, and multiplication. 3 hr. rec.
374. **Design of Computer Arithmetic Circuits II.** 3 hr. PR: E.E. 373. A continuation of the study begun in E.E. 373. High speed binary division, floating point arithmetic, modular or residue arithmetic, and techniques

for checking arithmetic are covered. Recent innovations are studied as literature becomes available. 3 hr. rec.

- 380. **Electrical Problems II.** 1-6 hr. For graduate students.
- 390. **Advanced Independent Study.** 1-6 hr. PR: Consent. Individual investigation in advanced electrical engineering subjects that are not covered in formal courses.
- 400. **Seminar.** 1-3 hr. PR: Consent. Each graduate student will give an oral description of his written research proposal soon after beginning his thesis research. This will typically be a 30-minute presentation before the faculty and graduate students.
- 411. **Nonlinear Control System Analysis.** 3 hr. PR: Consent. The application of Liapunov's and Popov's methods to nonlinear control systems, together with classical techniques. 3 hr. rec.
- 413. **Sample-Data Control Systems.** 3 hr. PR: E.E. 312 or consent. A study of control systems in which the activating signal is represented by samples at regular time intervals. 3 hr. rec.
- 416. **Synthesis of Feedback Systems II.** 3 hr. Continuation of E.E. 316. 3 hr. rec.
- 466. **Information Theory II.** 3 hr. Continuation of E.E. 366. 3 hr. rec.
- 471. **Switching Circuit Theory II.** 3 hr. PR: E.E. 370, Math 236, or equiv. Switching circuit theory is used to model the operations of networks of logic gates and flip-flops. Networks of this type are one form of discrete parameter systems. This course studies the use of the linear sequential machine as a means of modeling the general class of discrete parameter information systems. A system approach and the techniques of abstract algebra are used throughout. 3 hr. rec.
- 497. **Research.** 1-15 hr.

INDUSTRIAL ENGINEERING

Master of Science in Industrial Engineering

Students must comply with rules and regulations as outlined in general requirements for graduate work in the College of Engineering.

The M.S.I.E. degree program is designed to serve the graduate needs of a person holding a B.S.I.E. degree or an Industrial Engineering option in another field of engineering. Also, a person holding a degree in another field of engineering but who is willing to essentially fulfill the requirements of a B.S.I.E. degree may elect to pursue the M.S.I.E. degree. A review of the aims and objectives of each individual will permit exact evaluation of the courses required.

There are five core areas of study available:

- Core I—Transportation Science
- Core II—Operations Research and Statistical Analysis
- Core III—Computer and Systems Analysis
- Core IV—Human Factors Engineering
- Core V—Manufacturing Processes

Courses. No rigid curriculum is set up for the M.S.I.E. or M.S.E. degrees. At least half of the 30 hours required for either degree must be in courses in the Department of Industrial Engineering; this is exclusive of research. At least 12 hours should be courses included in the particular core area chosen. A minor may be selected in another core area, in another branch of engineering, in mathematics, or in the College of Business and Economics.

Thesis. A thesis is required for the M.S.I.E. degree. Students planning to receive the M.S.E. degree may elect to write the thesis or to take equivalent hours of course work. In case a thesis is written, it will be necessary to take all of the six hours of research work (I.E. 497). A thesis, however, is not automatically approved after the required number of semester hours of research work has been completed. The thesis must be presented in a form that conforms to the general requirements of the Graduate School, and in addition, must conform to the additional thesis requirements of the department.

Thesis Supervisor. Each student will be assigned to a thesis supervisor who will normally serve as chairman of his Examining and Advisory Committee.

Final Examination. On completion of his thesis and course work, the candidate will be given an oral examination by his Examining and Advisory Committee; additional examiners may be called in for this examination.

Industrial Engineering

I.E.

201. **Metal-Cutting Theory and Practice.** 3 hr. PR: I.E. 100 and Mat.E. 105. Metal-cutting tools, tool materials, work materials, cutting fluids, process of chip formation, cutting forces, tool-life tests, economics of tool life, measurement of product. 2 hr. rec., 3 hr. lab.
202. **Metal Forming Manufacturing Processes.** 3 hr. PR: I.E. 100 or consent. Applications and operations of the basic metal forming processes including the primary metal working processes and the metal shearing, drawing, binding, and squeezing processes, along with the machine tools required for these processes. 3 hr. rec.
203. **Metal Forming Theory.** 3 hr. PR: I.E. 202. The mechanics and basics of metal forming with elementary theoretical and descriptive investigations of tube-sinking, deep-drawing, wire-drawing, extrusion, cold rolling, and forging. 3 hr. rec.
204. **Metal Casting Manufacturing Processes.** 3 hr. PR: I.E. 100 and Mat.E. 105 or consent. Fluidity processes used in industry covering non-permanent processes such as sand molding, centrifugal molding, investment molding, and shell molding. Some permanent mold methods will be investigated along with metal processes, molding machines, and fundamentals of costing design. 3 hr. rec.

205. **Tool Design.** 3 hr. PR: I.E. 100. Design, construction, application, and economic aspects of jigs, fixtures, and special tools used in manufacturing on a production basis. 2 hr. rec., 3 hr. lab.
213. **Engineering Statistics.** 3 hr. PR or conc.: Math. 17, I.E. 281 or consent. The use of graphical analysis; measures of central tendency and dispersion; normal, binomial, and Poisson distributions in engineering applications; linear regression and correlation; tests of significance, nonparametric statistics, and analysis of variance. Includes applications of statistical sampling techniques in quality control. 3 hr. rec.
214. **Advanced Analysis of Engineering Data.** 3 hr. PR: I.E. 213. The application of advanced theories of statistical techniques to analyze and interpret industrial problems. Subjects include multiple regression, curvilinear regression, advanced analysis of variance, randomized complete blocks, Latin Square designs, factorial designs, transformations, and analysis of response curves. Accent is on proper design of experiments, proper interpretation of results, and thorough consideration of all errors of estimation and errors of inference. 3 hr. rec.
215. **Statistical Decision Making.** 3 hr. PR or Conc.: I.E. 213. Basic concepts of probability theory, discrete and continuous distributions, joint and derived distributions, with applications to a large number of industrial and research problems. Also covered are such topics as expectation, properties of estimates, and Markov chains (with examples related to everyday problems). Special emphasis on the applications of probability theory in operations research, quality control, and human factors engineering. 3 hr. rec.
216. **Industrial Statistics.** 3 hr. PR or Conc.: I.E. 213. Economic objectives of quality control in manufacturing through sampling methods; the Shewhart control chart for variables, attributes, and defects per unit; statistical approach to acceptance procedures. 3 hr. rec.
220. **Theory of Industrial Engineering and Organization.** 3 hr. PR: Graduate standing and consent. History and development of scientific management in industry with early works of Taylor, Galbreth, and Gantt, to the present time. 3 hr. rec.
222. **Job Evaluation and Wage Incentives.** 3 hr. PR: I.E. 140 or consent. Principles used in evaluating jobs, rates of pay, characteristics and objectives of wage incentive plans; incentive formulae and curves. 3 hr. rec.
241. **Methods Analysis.** 2 hr. PR: I.E. 140 or consent. An advanced study of the techniques of methods analysis as an effective means of methods improvement and cost reduction. 2 hr. rec.
243. **Plant Layout and Design.** 3 hr. PR: I.E. 142. Problems in industrial plant design. Equipment location, space utilization, layout for operation and control, flow sheets, materials handling. Allied topics in power utilization, light, heat, and ventilation. 1 hr. rec., 6 hr. lab.
249. **Design of Dynamic Materials Systems.** 3 hr. PR: I.E. 140, I.E. 142 or consent. The application of Industrial Engineering theory and practice to the selection of material systems and equipment. This is to include the efficient handling of materials from the first movement of raw materials to the final movement of finished product. Present quantitative design techniques will be included. 3 hr. rec.

250. **Introduction to Operations Research.** 3 hr. PR: I.E. 213. A study of the basic tools and philosophies of operations research. Tools to be presented include: linear programming, queueing theory, inventory theory, and simulation. Other operations research techniques will be presented as they relate to the overall systems philosophy.
251. **Analytical Techniques of Operations Research.** 3 hr. PR: I.E. 213. A study of the analytical techniques used in operations research and industrial engineering with special emphasis on their application to industrial systems and operations. Optimizing techniques will be presented for a wide range of situations. Specific techniques to be covered include: differentiation of continuous functions, differencing of discrete functions, Lagrangian multipliers, and Kuhn-Tucker conditions. Other optimizing techniques to be presented include linear programming, quadratic programming, geometric programming, branch-and-bound methods, and search techniques.
259. **Introduction to Systems Engineering.** 3 hr. PR: I.E. 214, conc.: I.E. 250, I.E. 277. The nature of scientific methodology including: quantitative synthesis of models with accompanying objectives and restrictions, definition of terms, sampling and measurement of components of the model, development and testing of assumptions, optimizing techniques, testing and controlling the model and the solution, and error sensitivity of the model. Emphasis will also be toward development of the problem-solver's ability to successfully assign resources to the problem solution phases in a manner such as to equalize the marginal cost of improving the model's reliability. This course will provide an opportunity for the student to analyze an operation as it may interact with the whole system. 3 hr. rec.
260. **Human Factors Engineering.** 3 hr. PR: Consent. An examination of human factors engineering and man-machine systems to include a study of ambient environment, human capabilities and equipment design. Application of human factors engineering in workplace design, maintainability, and task design methodology. Study of system design for man-computer interface, life support requirements, simulators and man-machine systems. 2 hr. rec., 3 hr. lab.
270. **Standard Manufacturing Costs.** 3 hr. PR: I.E. 170. Development of standards for labor, material, and overhead expenses; uses of standards for control; analyses of variances between standard and actual costs. 3 hr. rec.
277. **Engineering Economy.** 3 hr. PR: Junior standing. Comparison of the relative economy of engineering alternatives; compound interest in relation to calculation of annual costs; present worth and prospective rates of return on investments; methods of depreciation; sunk costs, increment costs; general economy studies with emphasis on retirement and replacement of equipment; consideration of taxes, public works, and manufacturing costs as related to economic solution of engineering proposals. 3 hr. rec.
280. **Industrial Engineering Problems.** 1-3 hr. PR: Consent. Special problems relating to industrial engineering.
281. **Digital Computation for Engineers.** 3 hr. Conc.: Math. 16. Study of processes of broadly integrating the digital computer into service for the engineer or scientist and study of the programming process with empha-

sis on coding with the automatic programming language Fortran. Considerable use will be made of the Computer Center equipment, especially the IBM 360 Model 75. Various other programming languages will be discussed. Considerable time will also be devoted to topics such as real-time control, principles of computer functions, study of available equipment, broad use categories of equipment, etc. 2 hr. rec., 3 hr. lab.

282. **Advanced Digital Computer Concepts.** 3 hr. PR: I.E. 181 or 281 or consent. Principles of digital computer functional components. Study of digital operating systems including structure of the various subsystem components such as monitors, input output control systems, and loaders. Advanced operating system concepts including multiprogramming, multiprocessing, teleprocessing, and time sharing will be covered. Various existing operating systems will be evaluated as well as principles in overall system design. 3 hr. rec.
283. **Information Retrieval.** 3 hr. PR: I.E. 181 or 281 or consent. Study of the tools, elements, and theories of information storage and retrieval. Areas of study include documentation, information framework; indexing; elements of usage, organization and equipment; parameters and implementation; theories of file organization and system design. 3 hr. rec.
284. **Simulation by Digital Methods.** 3 hr. PR: I.E. 213 or consent. An introduction to methods of simulation using the digital computer. Study of the methods of generating random numbers, the Monte Carlo technique, process generators, industrial dynamics models, methods of error analysis and reduction, and digital computer simulation languages such as Simscript, Dynamo and especially GPSS (General Purpose System Simulator-360). The student will be provided the opportunity to use the digital computer to simulate moderately complex production, inventory, queueing and maintenance systems. Although the primary emphasis is more practically restricted to models of industrial operations, the techniques are immediately adaptable to simulation of any physical or information system. Simulated experiments are also considered. 3 hr. rec.
285. **Electronic Computer Data Processing.** 3 hr. PR: Senior standing. Fundamentals of digital computer operations, equipment characteristics, input and output components. Elements of number systems. Fundamentals of "IR," information retrieval. Emphasis is placed on integrated systems analysis and design, business and industrial data for computer applications, and fundamentals of programming. Existing equipment systems and the economics of their applications will be reviewed.
300. **Advanced Manufacturing Processes.** 3 hr. PR: I.E. 100. A study of the newer and more complex manufacturing methods used in industry today. Welding and forming of titanium, magnesium, beryllium, and similar metals; assembly processes; powder metallurgy; adhesives and bonds; electrical and chemical operations such as electro-forming and hot-dipping operations; hot forging; high energy rate forming (HERF); automated manufacturing processes including transfer mechanisms, continuous, and point-to-point numerical control; plastic tooling and fabrication methods; marking processes; and other manufacturing processes will be examined. 3 hr. rec.
301. **Advanced Metal-Cutting Theory and Practice.** 3 hr. PR: I.E. 201. The development of metal-cutting as a science through research, cutting-fluid theory, machinability of materials, tool materials, hot machining, tool-life tests, economics of machining. 2 hr. rec., 3 hr. lab.

309. **Automation in Industry.** 3 hr. PR: I.E. 100 or consent. The evolution, production fundamentals, and control systems of the principal fully automatic machine tools, both fixed and flexible, will be covered along with the basic philosophy, fundamentals, and methods of automation as practiced in industry today. 3 hr. rec.
314. **Advanced Design of Industrial Experiments.** 3 hr. PR: I.E. 214. A study of several of the more complex statistical methods including sequential analysis, analysis of covariance, multiple range tests, transformation of data, orthogonal polynomials, large factorial experiments, confounding, fractional replication, split-plot designs, lattice designs with one and two restrictions on treatment allocation, with special emphasis on the power, relative efficiency, and interpretation of these designs. Experimental optimization techniques also will be covered, including the sequential simplex method, pattern search, Powell's method, and Rosenboch's method.
316. **Advanced Industrial Statistics.** 3 hr. PR: I.E. 213. Advanced study of the economic application of statistics to quality control problems. Particular emphasis on developing models of quality control systems on the basis of statistical decision theory. Double and sequential sampling by attributes. Variables sampling plans. Advanced control chart methods. 3 hr. rec.
325. **Management Control.** 3 hr. PR: I.E. 170 or consent. A study of effective techniques for higher management control, including current concepts and controls applicable to production management problems.
340. **Advanced Time Study.** 3 hr. PR: I.E. 140. Review of the various investigations which have been made, with special consideration given to the development of these studies into new fields. 3 hr. rec.
341. **Methods Analysis and Work Simplification.** 3 hr. PR: I.E. 140, 277. An advanced study of the techniques of methods analysis, including modern means of methods research. Development of appropriate cost analyses to accompany improved operating plans. A study of the design, installation, and administration of work simplification programs, suggestion systems, and remuneration policies, and the means of intra-plant communications concerning such programs. 2 hr. rec., 3 hr. lab.
342. **Advanced Production Control.** 3 hr. PR: I.E. 250. A study of the different mathematical models useful in the design of effective production control systems. The various models to be covered include: static production control models under risk and under uncertainty, dynamic models under certainty, under uncertainty, and under risk.
353. **Applied Mathematical Programming.** 3 hr. PR: I.E. 250 or consent. Application of the assignment, transportation, and simplex algorithms to typical industrial and economic problems. The methods and computational efficiencies of the revised simplex and other algorithms are also studied and compared with the conventional methods. Computational methods of duality and the dual-simplex and primal-dual algorithms are covered. The following special topics are also included: effect of changes or addition of vectors, secondary constraints, the decomposition principles, fixed changes (intercepts), upper bound constraints, and transshipment. 3 hr. rec.
358. **Special Topics in Systems Analysis and Operations Research.** 3-6 hr. PR: Consent. Special topics from recent developments in operations research

and related fields. Special emphasis will be placed on interests of current graduate students.

- 360. **Human Factors System Design.** 3 hr. PR: I.E. 260. A study of the theoretical aspects and practical applications of man machine relationships as they influence future system design. In this course the student will examine human limitations with respect to the acceptance of information, decision making, and the ability to transmit the result of such decisions to the controlled equipment systems for the purpose of obtaining design optimization. 2 hr. rec., 3 hr. lab.
- 368. **Advanced Problems in Human Factors.** 1-3 hr. PR: I.E. 260 or 360 and graduate standing. Special problems relating to one of the areas of human factors such as simulation, controls, vigilance, maintainability, etc.
- 370. **Budget Control.** 3 hr. PR: I.E. 270. Principles involved in the preparation of budgets by functional divisions and the application of divisional budgets as control media. 3 hr. rec.
- 377. **Advanced Engineering Economy.** 3 hr. PR: I.E. 277. Special emphasis on depreciation, engineering and economic aspects of selection and replacement of equipment; relationship of technical economy to income taxation and load factor and capacity to economy. 3 hr. rec.
- 381. **Integrated Data Processing.** 3 hr. PR: I.E. 281 and consent. Advanced work in electronic data-processing systems and procedures design. Case studies of integrated data-processing systems. Course projects will include individual use of a computer in management data-processing analysis problems. 3 hr. rec.
- 385. **Digital Computer Applications.** 1 hr. PR: Graduate Standing in Engineering, Physical Science or Mathematics. Introduction to methods of digital computation and study of the programming process with emphasis on coding with an automatic programming language for scientific problems (FORTRAN). The student will have considerable opportunity to analyze engineering and scientific problems using the facilities available at the University Computer Center. 2 hr. rec., 3 hr. lab. (5-week period.)
- 431. (C.E. 302). **Traffic Flow Theory.** 3 hr. PR: I.E. 213 and C.E. 439 or consent. Topics to be included are hydrodynamic, car-following, and queueing theory models of traffic flow. Particular emphasis will be given to the applicability of these models to true traffic situations. Other topics to be covered will be traffic simulation, freeway flow models, expressway surveillance, pedestrian and traffic delay at traffic signals, turning at intersections, parking problems, merging traffic or limited access facilities. 3 hr. rec.
- 452. **Queueing Theory.** 3 hr. PR: I.E. 213 and 215. Best operating conditions for systems involving waiting times. Elements of stochastic processes. Single-channel and multi-channel models. Computational methods, including Monte Carlo techniques. Applications to problems such as maintenance and inventory control. 3 hr. rec.
- 453. **Theory of Linear Programming.** 3 hr. PR: I.E. 250 or consent. A study of the procedures available for solving large-scale optimization problems using linear programming. Topics covered include decomposition techniques, multiple pricing, cycling, inverse generation and storage, ranging procedures, and upper bound algorithms.
- 454. **Inventory Theory.** 3 hr. PR: I.E. 215. A study of techniques used in the optimization of inventory systems. Elements of static, deterministic in-

- ventory models, and static, stochastic inventory models. Dynamic inventory models. Selected topics related to inventory analysis. 3 hr. rec.
455. **Probability Theory for Engineers.** 3 hr. PR: I.E. 215. Study of probability theory and its application to industrial systems with particular emphasis on inventory systems, queueing models, maintenance, reliability, and quality control. Areas of study include mathematical models of random phenomena, basic probability theory, mean and variance of a probability law, probability laws and their application to inventory and queueing theory, expectation of a random variable, cost and profit as functions of random variables.
456. **Applied Stochastic Processes.** 3 hr. PR: I.E. 215, I.E. 251, I.E. 455. Study of stochastic systems with particular emphasis on application to inventory and queueing theory. Areas of study include conditional probability, Poisson processes, counting processes, renewal processes, Markov chains with discrete and continuous parameters.
480. **Seminar.** 1-6 hr. PR: Consent. Discussion of research in industrial engineering and special problems.
497. **Research.** 1-15 hr.

MECHANICAL ENGINEERING

Students must comply with the rules and regulations as outlined in the general requirements for graduate work in the College of Engineering. A graduate student electing mechanical engineering as his major should have had the equivalent of an E.C.P.D.-accredited undergraduate degree in mechanical engineering or be willing to remove any deficiencies prior to starting on a graduate program. In addition, a graduate student in the Department of Mechanical Engineering must comply with the departmental requirements as outlined below.

Master of Science in Mechanical Engineering

Courses. No rigid curriculum is set up for the M.S.M.E. degree. Certain general requirements must be met, however, by all candidates for this degree. Each student, in concert with his adviser, is expected to develop a plan of study, as soon as possible, indicating his courses and the area of his thesis interest. The plan should include at least six semester hours of advanced mathematics beyond differential equations and may also include courses in physics or chemistry in the 200 to 400 series. A minimum of twelve hours should be taken in mechanical engineering courses, with two-course depth in at least one major area. The remaining courses may be selected from other departmental offerings in the College of Engineering when particularly suited to the objectives of the student. In general, at least one-half of the hours listed in the plan should be at the 300-400 level. No 200-level course that is required in the undergraduate curriculum in mechanical engineering may be taken for graduate credit. Any deviation or modification of the plan shall be subject to prior approval of the adviser.

Thesis. A thesis is normally required of all candidates for the degree of Master of Science in Mechanical Engineering.

Final Examination. Candidates for the M.S.M.E. degree may be required to pass a final examination administered by his advisory committee. This examination may be written or oral or both and may cover material in the courses or thesis area of the student.

The Degree of Doctor of Philosophy

Students intending to pursue a Ph.D. program in mechanical engineering should have earned a B.S. or M.S. degree in mechanical engineering or an equivalent curriculum. While it is possible for a student with a B.S. degree to enroll directly in the Ph.D. program, it is usually advisable for him to earn the M.S.M.E. first. An exception might be indicated for anyone planning to enter the teaching profession or on a special doctoral support program.

As with the M.S.M.E. program, the courses of study are selected to fit the individual interests and objectives of the student, with proper attention given to the rounding out of related areas of study.

The research work for the doctoral dissertation is expected to represent a significant contribution to the art or science of engineering. It may entail a fundamental investigation into a specialized area, or a broad and comprehensive study of a novel system design. In either case, a high degree of creative and original effort is required to meet the standards of acceptability.

The student must pass a final examination in defense of his dissertation administered by his research committee.

Mechanical Engineering

M.E.

- 210. **Kinematics.** 3 hr. PR: M.E. 112 and Math. 18 or consent. Geometry of constrained motion. kinematic synthesis and design, special linkages. Coupler curves, inflection circle, Euler-Savary equation, cubic of stationary curvature and fine displacement techniques. 3 hr. rec.
- 222. **Mechanical Vibrations.** 3 hr. PR: Math. 18 and T.A.M. 104 or consent. Fundamentals of vibration theory. Free and forced vibration of one, two and multiple degree of freedom systems, transient analysis. Solution by Fourier and Laplace Transformation. Methods of Rayleigh. Holzer, and Stodola. Conservative systems and LaGrange's equation. 3 hr. rec.
- 226. **Friction, Lubrication, and Wear.** 3 hr. PR: Senior standing. Frictional phenomena in solids, liquids, and gases. Hydrodynamic lubrication theory and bearing design. Hysteresis, adhesion, abrasion, and wear effects. Examples of frictional behavior will be discussed and demonstrated. 3 hr. rec.
- 232. **Introductory Engineering Systems Analysis.** 3 hr. PR: Senior standing. A study of analogous and mixed systems. Similitude of mechanical,

electrical, and acoustic dynamic systems. Dimensional analysis and theory of model design. 3 hr. rec.

- 236. **Systems Analysis of Space Satellites.** 3 hr. PR: Senior standing in engineering. Introduction to the engineering principles associated with the analysis and design of space satellites. Emphasis is upon the interdisciplinary nature of satellite systems analysis. 3 hr. rec.
- 240. **Problems in Thermodynamics.** 3 hr. PR: M.E. 141 or consent. Detailed study of thermodynamics systems with special emphasis on actual processes. The problems presented are designed to strengthen the background of the student in the application of the fundamental thermodynamic concepts. 2 hr. rec., 3 hr. lab.
- 244. **Introduction to Gas Dynamics.** 3 hr. PR: M.E. 144 or consent. The basic fundamentals of gas dynamics, one-dimensional gas dynamics and wave motion, methods of measurement, effect of viscosity and conductivity, and concepts from gas kinetics. 3 hr. rec.
- 252. **Heat Transfer II.** 3 hr. PR: M.E. 152. A continuation of M.E. 152, covering nonlinear extended surface; gas radiation; freezing; heat exchanger theory; recovery factor and high speed flow; and mass transfer. Also, periodic flow and application of the digital computer to problems in heat transfer. 3 hr. rec.
- 262. **Internal Combustion Engines.** 3 hr. PR: M.E. 101 or M.E. 141. The thermodynamics of the internal combustion engine; Otto cycle; Diesel cycle; two- and four-cycle engines, fuels, carburetion and fuel injection; combustion; engine performance, supercharging. 3 hr. rec.
- 264. **Heating, Ventilating, and Air Conditioning.** 3 hr. PR: M.E. 141 or consent. Methods and systems of heating, ventilating, and air conditioning of various types of buildings, types of controls and their application. 3 hr. rec.
- 266. **Steam Turbines.** 3 hr. PR: M.E. 141. The theory of fluid dynamics and the thermodynamics of the modern turbines; materials, construction details and design of important elements; influences on economy of variations in cycles and operative ranges. 3 hr. rec.
- 282. **Engineering Acoustics.** 3 hr. PR: Math 18 and consent. Use of fundamental principles of mathematics and physics to develop the basic theories of sound. Application of these theories involving sound in closed areas, the various modes of sound transmission, noise control and psycho-acoustic criteria. 3 hr. rec.
- 284. **Introduction to Feedback Control Theory.** 3 hr. PR: Math. 18 and E.E. 105 or equivalent background. Introduction to automatic control systems and concepts of feedback. Transfer function analysis of the equations of motion. Transient and steady state response. Stability criteria using Nyquist, root locus and frequency response techniques. 3 hr. rec.
- 290. **Seminar.** 1-6 hr. PR: Junior, senior, or graduate status and consent.
- 294. **Special Topics.** 1-6 hr. PR: Junior, senior or graduate status and consent.
- 299. **Mechanical Problems.** 1-6 hr. For junior, senior, and graduate students.
- 322. **Advanced Vibrations.** 3 hr. PR: M.E. 22 or consent. Dynamic and harmonic analysis of multiple degree of freedom and continuous linear systems. Lagrange's equations and matrix techniques. Use of analog and numerical techniques. 3 hr. rec.

326. **Interface Phenomena.** 3 hr. PR: M.E. 226 or consent. Phenomenological and molecular theories of adhesion. Interrelationship of adhesion and hysteresis, stability criteria and non-linear effects in bearings. Recent developments in lubrication theory. Elastohydrodynamic effects, surface energy criteria, and theories of wear. 3 hr. rec.
333. **Advanced Machine Design.** 3 hr. Stresses in indeterminate machine parts, experimental stress analysis. Design for high temperatures, pressures and speeds. Bearings and lubrication. Rotating discs and elastic stability and high speeds. Residual stresses and creep. 3 hr. rec.
340. **Advanced Thermodynamics I.** 3 hr. PR: M.E. 141. Definitions and scope of thermodynamics. First and Second laws, Maxwell's relation, Calpeyron relations, equation of state, thermodynamics of reactive systems, availability.
342. **Advanced Thermodynamics II.** 3 hr. PR: M.E. 340 or consent. Methods of statistical mechanics; concepts of temperature; perfect diatomic gases and crystalline solids, Jacobian equations of thermodynamics; grand potential function.
350. **Conduction Heat Transfer.** 3 hr. PR: M.E. 152 or consent. Analytical, numerical, graphical, and analog solutions of steady and non-steady heat conduction problems in isotropic and anisotropic solids. Representative topics include: thermal properties, extended surfaces, thermal stress, interphase conduction with moving interface, localized and distributed sources.
353. **Convection Heat Transfer.** 3 hr. PR: M.E. 152 or consent. Rigorous study of the fundamental mechanisms of the heat convection processes in both laminar and turbulent flows. Analytical, numerical, and analogical solution as applied to convective systems. Selected topics for discussion as related to student interest and study of current research publications.
355. **Radiation Heat Transfer.** 3 hr. PR: M.E. 152. Classical derivation of black body radiation laws; grey body and non-grey analysis; radiant properties of materials, radiant transport analysis, specular-diffuse networks, gas radiation, thermal radiation measurements: analytical, numerical solutions, and study of selected current publications.
364. **Turbomachinery.** 3 hr. PR: M.E. 101 or M.E. 141. A study of flow problems encountered in the design of water, gas, and steam turbines, centrifugal and axial flow pumps and compressors, design parameters.
380. **Engineering Similitudes.** 3 hr. PR: Consent. Development of the dimensional analysis concepts and techniques and their application in model design. Rational approach to the design of distorted models. Study of analogies from a standpoint of model-prototype relations. 3 hr. rec.
390. **Seminar.** 1-6 hr. For senior and graduate students.
394. **Special Topics.** 1-6 hr. For senior and graduate students.
422. **Random Vibrations.** 3 hr. PR: M.E. 222 or consent. Characterization of random motion. Response of linear time invariant systems. First and second failure problems. Fatigue under random excitation. 3 hr. rec.
440. **Irreversible Thermodynamics I.** 3 hr. PR: M.E. 340 or consent. Phenomenological treatment of the laws of dynamics and thermodynamics for irreversible processes in continuous media. The linear laws for combined irreversible phenomena including viscous dissipation, heat conduction, diffusion, chemical reactions and electric and magnetic effects, are developed taking into account Curie's principle and the Onsager

relations. The principle of the minimum rate of creation of entropy is extended to establish criteria for the stability of stationary states. Tensor and variational methods are employed.

- 441. **Irreversible Thermodynamics II.** 3 hr. PR: M.E. 440. A continuation of M.E. 440 with emphasis on selected topics from such applications as thermoelectricity, anisotropic heat conduction, stability of fluid motion, thermal diffusion and separation, visco-chemical drag, electro chemical cells, and other coupled phenomena of physical or biological interests.
- 462. **Advanced Internal Combustion Engines.** 3 hr. PR: M.E. 262 or consent. Combustion in spark ignition engines; compression ignition engines; detonation; fuel air ratios; heat losses; lubrication; efficiencies; two-stroke engines; four-stroke engines, performance, exhaust turbines; gas turbines. 3 hr. rec.
- 466. **Advanced Refrigeration.** 3 hr. PR: M.E. 264. Thermodynamics of vapor cycles, refrigerants, fluid flow, heat transfer, psychometrics, types of refrigeration and equipment required, application of refrigeration in industry, food preservation. 3 hr. rec.
- 490. **Seminar.** 1-3 hr. PR: Consent. Discussion, library readings, and individual study reports in the mechanical engineering field.
- 497. **Research.** 1-15 hr.

THEORETICAL AND APPLIED MECHANICS

Master of Science in Theoretical and Applied Mechanics

Students must comply with rules and regulations as outlined in the Guide to the Graduate Program in Engineering.

Courses. At least 30 semester hours are required for the degree of Master of Science in Theoretical and Applied Mechanics. At least 12 of these hours, exclusive of thesis, must be in the Department of Theoretical and Applied Mechanics. As many courses as are possible should be those restricted to graduate students only. A minor in one of the other branches of engineering, physics, or mathematics is possible.

Thesis. A thesis is usually required for the degree of Master of Science in Theoretical and Applied Mechanics, and is ordinarily for 6 hours credit. The thesis must conform to the general requirements of the Graduate School and to the additional requirements of the Department.

Thesis Supervisor. Each student will be assigned a thesis supervisor who will serve as chairman of his thesis committee.

Final Examination. On completion of his thesis, the candidate for the degree of Master of Science in Theoretical and Applied Mechanics will be given an oral examination by his thesis committee. Additional examiners may be called in for this examination.

The Degree of Doctor of Philosophy

A candidate for the degree of Doctor of Philosophy must comply with the rules and regulations as outlined in general

requirements for graduate work in the College of Engineering. Graduate students electing Theoretical and Applied Mechanics as their major must have had the equivalent of the undergraduate courses in mechanics required for a bachelor's degree in any of the curricula in the College of Engineering.

A graduate student who has received a master's degree from a school which has an undergraduate curriculum in the area of his master's degree accredited by E.C.P.D. may pursue a Ph.D. degree in Theoretical and Applied Mechanics if he meets the other requirements of the Department.

Candidates for the Doctor of Philosophy degree, regardless of their specific major, must attain a proficiency in each of the following areas: (1) mechanics of solids, (2) mechanics of fluids, (3) dynamics, (4) experimental mechanics. In addition, each candidate must include at least four mathematics courses in his program of study.

Theoretical and Applied Mechanics

T.A.M.

- 202. **Advanced Laboratory.** 3 hr. PR: Consent. Applied engineering measurements and instrumentation dealing with mechanical phenomena as force, displacement, pressure, torque, velocity and acceleration. Introduces students to various transducer, signal conditioning, and readout equipment. Time allowed for term project of specific student interest. Offered spring of even years.
- 280. **Special Problems in Mechanics.** 1-3 hr. PR: Consent. For junior, senior, and graduate students. Offered every semester and summer.
- 300. **Advanced Mechanics of Materials I.** 3 hr. PR: T.A.M. 52 or consent. Theories of failure and design procedures; time and temperature dependent behavior; shear center, unsymmetrical bending, curved beams. 3 hr. rec. Offered each fall.
- 301. **Theory and Application of Oscillatory Phenomena.** 3 hr. PR: T.A.M. 52. Study of oscillations or vibrations in acoustical, electrical, hydraulic and mechanical systems. 3 hr. rec. Offered in spring of even years.
- 304. **Perturbation Methods.** 3 hr. PR: Consent. A unified treatment of formal perturbation methods used in solving engineering problems with linear and non-linear differential equations that are unsolvable by elementary techniques. Topics to be covered include the conventional perturbation technique, inner and outer expansions, methods of multiple scales, the iteration technique and other current, related, methods of analysis. Offered each fall.
- 305. **Analytical Methods in Engineering I.** 3 hr. PR: Consent. A course designed to provide training in the applications of modern mathematics to engineering problems. Course content includes: index notation for determinants, matrices, and quadratic forms; linear vector spaces, linear operators including differential operators; eigenvalue problems. Offered each fall.
- 306. **Analytical Methods in Engineering II.** 3 hr. PR: Consent. Usually a continuation of T.A.M. 305; however, course content may vary to suit special needs or interests of students. Subject matter usually chosen

from advanced topics in linear and nonlinear analysis. Offered each spring.

310. **Advanced Mechanics of Materials II.** 3 hr. PR: Consent. Beams on elastic support, torsion of noncircular sections, thick wall cylinders and rotating disks, contact stresses, stress concentrations. Energy methods. Other special topics. 3 hr. rec. Offered each spring.
312. **Inelastic Behavior of Engineering Materials.** 3 hr. PR: T.A.M. 300. Rheological aspects of inelastic behavior, inelastic load-stress relationship for members subjected to axial, bending, torsion and buckling loads. Analytical stress-strain relationships and material modeling. Combined loading, interaction curves and their use. Statically indeterminate members loaded inelastically; inelastic buckling theory. 3 hr. rec. Offered fall of even years.
316. **Energy Methods in Applied Mechanics.** 3 hr. PR: Consent. Introduction to variational principle of mechanics and applications to engineering problems; principle of virtual displacements, principle of minimum potential energy, principle of complementary energy. Castigliano's theorem, Hamilton's principle. Applications of energy principles to theory of plates, shells, and stability. 3 hr. rec. Offered each fall.
318. **Continuum Mechanics.** 3 hr. PR: Undergraduate mechanics. A course designed to emphasize the basic laws of physical behavior of continuous media. Course content to include: analysis of stress; equations of motion and boundary conditions; kinematic analysis; rates of strain, dilatation and rotation; bulk time, rates of change; constitutive equations with special attention to elastic bodies and ideal fluids; energy equations and the first law of thermodynamics. 3 hr. rec. Offered each fall.
320. **Theory of Elasticity I.** 3 hr. PR: Consent. A basic solid mechanics course to include: Cartesian tensors; equations of classical elasticity, energy, minimum, and uniqueness theorems for the first and second boundary value problems; St.-Venant principle; extension, torsion, and bending problems. 3 hr. rec. Offered each fall.
325. **Experimental Stress Analysis.** 3 hr. PR: T.A.M. 103, 104. Introduction to some of the more common experimental methods of analyzing stress distributions. Classical photoelasticity, brittle lacquers, birefringent coatings, strain gage techniques and instrumentation, as applied to problems involving static, dynamic and stress distributions. 2 hr. rec., 3 hr. lab. Offered each fall.
330. **Instrumentation in Engineering I.** 3 hr. PR: Consent. Theory of measuring systems, emphasizing measurement of rapidly changing force, pressure, strain, temperature, vibration, etc. Characteristics of currently available instruments, methods of noise elimination, types of recording are studied. Students in small groups in laboratory operate modern instruments for first-hand experience. Of special value to students who will do an experimental thesis. 2 hr. rec., 3 hr. lab. Offered each spring.
342. **Biomechanics Seminar I.** 3 hr. PR: Consent. Introduction to the principles and terminology of biomechanics, guest lecturers in anatomy, physiology, surgery and biology; critical review of research papers of current interest and a consideration of the sources and forms of the literature. 3 hr. rec. Offered each fall.
352. **Intermediate Dynamics.** 3 hr. PR: T.A.M. 104. The course covers Newtonian mechanics of a particle and systems of particles (including aggregate mass systems), Lagrangian dynamics and the mechanics of

rigid bodies. Problems such as the dynamics of spinning tops, gyroscopes, spacecraft, etc., are considered. 3 hr. rec. Offered each fall.

353. **Advanced Dynamics I.** 3 hr. PR: T.A.M. 352 or consent. A review of the mechanics of particles and rigid bodies will precede the development of the geometric theory of dynamical systems. The stability of multi-degree-of-freedom autonomous and non-autonomous systems will be studied by the use of the Routh-Hurwitz criterion, Liapounov's direct method, Floquet's theory, variation equations, etc. Analytical solution by perturbation techniques will be presented. 3 hr. rec. Offered each fall.
360. **Flow of Non-Viscous Fluids.** 3 hr. PR: Consent. Introduction to potential theory, conservative force fields, continuity equation, energy equation, equation of state, ideal fluid. Derivation of Bernoulli equation. Complex variable with applications in potential flow. 3 hr. rec. Offered each fall.
414. **Theory of Buckling.** 3 hr. PR: Consent. Fundamental theorems for the investigation of stability of mechanical systems. Application to discrete systems and development of stability equations for elastic bodies. 3 hr. rec. Offered spring of even years.
419. **Non-Linear Continuum Mechanics.** 3 hr. PR: T.A.M. 318 or consent. Study of the basic laws of continuous media in the language of generalizer tensors. Emphasis on the structure of the constitutive equations for various classes of media with particular attention to elastic, plastic and viscoelastic media. 3 hr. rec. Offered spring of even years.
421. **Theory of Elasticity II.** 3 hr. PR: T.A.M. 320. Continuation of T.A.M. 320 to include: equations of classical elasticity in generalized coordinates; complex variables and potentials; plane stress and strain; various special problems. 3 hr. rec. Offered each spring.
424. **Theory of Thin Shells.** 3 hr. PR: Consent. Theoretical basis for analysis of shell-type structures. Material includes differential geometry of surfaces, current shell theories, and stability criteria. 3 hr. rec. Offered spring of odd years.
431. **Instrumentation in Engineering II.** 3 hr. PR: T.A.M. 330. Continuation of T.A.M. 330 with emphasis on transducers for static and dynamic measurement, and their use in practical measuring systems. 3 hr. rec. Offered fall of odd years.
440. **Photoelasticity.** 3 hr. PR: T.A.M. 300, 325. Theory of optics, birefringence, stress-optic law, polariscope, compensation. Techniques of model making, photography, polariscope use. Photoelastic coating methods and use of various reflective polariscopes. Data interpretation by various methods including principal stress separation by shear difference, oblique incidence and graphical integration. 2 hr. rec., 3 hr. lab. Offered fall of odd years.
443. **Biomechanics Seminar II.** 3 hr. PR: T.A.M. 342 or consent. Continuation of T.A.M. 342 with emphasis on the medical applications of engineering and the techniques of mathematical modeling to biological systems. 3 hr. rec. Offered each spring.
454. **Advanced Dynamics II.** 3 hr. PR: Consent. Dynamics of continuous solids. Wave motion; study of string motion in detail in order to introduce methods for attacking more general problems such as vibration of beams, membranes and plates. Stress propagation in unlimited solids; dilatational, distortional, and surface waves. 3 hr. rec. Offered fall of odd years.

461. **Flow of Viscous Fluids.** 3 hr. PR: Consent. The viscous flow of Newtonian and non-Newtonian fluids will be studied with emphasis on flows with low reynolds number. A rational approach to the fluid dynamics of particulate systems will be presented and problems associated with two phase particulate flow and flow through packed beds will be considered.
480. **Advanced Independent Study.** 1-3 hr. PR: Consent. Advanced study in areas not covered by formal courses. Offered each semester and summer.
497. **Research.** 1-15 hr. I, II, S.



Engineering Sciences Building

College of Human Resources and Education

The College of Human Resources and Education includes the Divisions of Clinical Studies, Education, and Family Resources. Established in 1965, the College brings together several disciplines and professions devoted to the study and maximum development of human talent and resources, whether in the context of the school, the family, or the community. Programs of instruction, research, and extended service are carried out in each of the divisions of the College and in close cooperation with the related departments and divisions in other sectors of the University.

Admission and Curriculum

All students apply for admission to the Graduate School through the Office of Admissions and Records. All candidates for graduate degrees must conform to the general regulations of the Graduate School. Such general regulations and the steps to be followed in the admissions process are covered in Part II of this catalog. Certain details in regard to admission to specific graduate programs of the College are provided on following pages. Additional information may be obtained by writing to the respective department chairman in which the graduate program is offered, or by writing to the Dean of the College.

The curriculum and degree requirements of the various master's degree programs of the College are shown in each of the respective divisions and departments. It is the responsibility of the student to take steps to insure that he is properly informed in regard to the requirements of the degree toward which he aspires and/or the certification standards to which he may wish to conform. Members of the faculty in general, and the student's adviser in particular, will offer counsel to the student on these matters on request.

The Degree of Doctor of Education

The Doctor of Education degree is offered with the following major areas and emphases:

1. Curriculum and Instruction
 - a. Curriculum Development
(Elementary and Secondary areas)
 - b. Educational Psychology
 - c. Engineering Education
 - d. Health Education

- e. Industrial Arts Education
- f. Music Education
- g. Physical Education
- h. Reading
- i. Safety Education
- j. Special Education
- 2. Counseling and Guidance
- 3. Education Administration

Admission. Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School. All applicants for admission to the doctoral program in the College of Human Resources and Education must submit scores on the Aptitude Test of the Graduate Record Examination and comply with each of the General Regulations of the Graduate School outlined in Part 1 and Part 2 of this catalog. Acceptance for study toward the doctoral degree in a specific area of concentration will be made by the faculty of the specific program and department.

Doctoral Committee. Having received an affirmative recommendation for admission to a specific program, the student recommends a chairman and four committee members as his doctoral committee for approval by the faculty members involved, the chairman of the department, and the Dean of the College. At least one member of the doctoral committee must come from a supporting discipline outside the College of Human Resources and Education and no more than three from any single division within the College.

Curriculum. The final determination of the program of course work and research is the responsibility of the student's doctoral committee. The Doctor of Education degree is not awarded on the basis of the completion of any set number of credits but is awarded on the basis of demonstrated academic achievement and scholarly competence. The minimum course work shall be 70 credits of relevant graduate work, excluding dissertation credit but including credits of relevant graduate work completed at the master's degree level. A minimum of 24 of the 70 semester hours shall be in the area of major concentration and a minimum of 24 of the 70 hours from a minor area of concentration in a supporting or related discipline.

Admission to Candidacy Examination. The purposes of the admission to candidacy examination are to assess the quality of the student's academic achievement, to review the student's program of course work, to approve a proposed outline of dissertation research, and to admit the student to formal candidacy for the degree. The student must make application through his adviser to the appropriate department chairman to take the Admission to Candidacy Examination.

The examination may be taken after at least two-thirds of the student's program of course work has been completed but prior to the dissertation phase of the program. The admission to candidacy examination consists of two parts: (a) a written examination, and (b) an oral examination. The candidate must pass the written examination prior to taking the oral portion. The written examination will include specifically prepared written examinations in the major area of concentration and in the area of concentration in the supporting discipline and will include such foundation area competencies as determined necessary by the student's doctoral committee. The written examination may be repeated one time and, upon consent of the dean, director of the appropriate division, chairman of the appropriate department, and the coordinator of the major program, may be repeated a second and third time. At least six months must elapse between repeated examinations.

The oral portion of the admission to candidacy examination will be administered by the student's doctoral committee at the call of and under the direction of the committee chairman after successful completion of written portion of examination. If not passed, it may be repeated one time and on recommendation of the doctoral committee, may be repeated a second time. At least six months must elapse between repeated examinations. On successful completion of the admission to candidacy examination, the student will be admitted to formal candidacy for the doctoral degree.

Dissertation. The candidate must submit and justify a prospectus for his doctoral dissertation at the oral portion of the admission to candidacy examination. The doctoral committee must review and *approve, approve with change, or reject* this outline or prospectus. The student shall consult with all members of the doctoral committee and with other appropriate members of the University faculty during the dissertation phase of his program.

Final Oral Examination. The student will be admitted to a final oral examination upon completion of his dissertation and after he has fulfilled all other requirements set by his committee. This examination will be conducted by his doctoral committee and will be open to all members of the University faculty. The candidate will not be recommended for the doctoral degree if he receives more than one unfavorable vote from his doctoral committee.

Time Limitation. All requirements must be completed within seven years.

Residency. A minimum of two semesters of residence in full-time graduate study at West Virginia University.

Certificate of Advanced Study in Education

This program is designed to prepare school and related personnel who wish professional training beyond the master's degree. Candidates for this Certificate may choose from among the following areas of study for their area(s) of concentration: (a) Administration and Supervision; (b) Curriculum and Instruction; (c) Counseling and Guidance, Reading, and Special Education; and (d) Physical Education. Persons interested in this certificate should consult with the director of the appropriate division or the Dean of the College of Human Resources and Education.

Admission. Individuals who wish to pursue a program leading to the Certificate of Advanced Study degree must be admitted to the Graduate School. All applicants for admission to the program in the College of Human Resources and Education must submit scores on the Aptitude Test of the Graduate Record Examination and comply with each of the General Regulations of the Graduate School outlined in Part I and Part II of this catalog. Acceptance for study toward the Certificate of Advanced Study degree in a specific area of concentration will be made by the faculty of the specific program and department.

Requirements for Admission to Candidacy

1. Evidence through examination, personal letter, and personal interview of general proficiency, acceptable standards of oral and written communication.
2. Satisfactory completion *in residence* at WVU of at least 6 semester hours of approved course work beyond the conferring of the master's degree.

Requirements for Completion

The Program. An approved program consisting of a minimum of 30 semester hours earned above the master's degree including 24 hours of course work in the College of Human Resources and Education or in closely related fields and 6 hours of research.

At least 24 semester hours of the work credited for this Certificate must be done in residence at West Virginia University. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in West Virginia University Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate. The minimum period of full-time graduate study in residence at West Virginia University is one semester or one full summer session.

Final Examination(s). Upon completion of all requirements including the research report, the candidate will be admitted to a final oral examination by his graduate committee.

Time Limitation. All requirements must be completed within seven years immediately preceding the awarding of the Certificate.

DIVISION OF CLINICAL STUDIES

The Division of Clinical Studies includes the programs of Counseling and Guidance, Reading, Rehabilitation Counseling, Special Education, and Speech Pathology and Audiology. The Division offers three programs leading to the Master of Arts and two programs leading to the Master of Science degree. The degree of Doctor of Education is offered in the areas of Counseling and Guidance, Reading, and Special Education.

The candidates for graduate degrees must meet the general regulations of the Graduate School, the College of Human Resources and Education, and specific regulations as required by the Department programs. Descriptions of the admission, curriculum, and degree requirements are shown in the respective program sections.

A person who wishes to pursue a graduate program leading to a degree in the Division of Clinical Studies must meet the general requirements for admission to the Graduate School and the College of Human Resources and Education. Additionally, to be admitted to candidacy for the master's, certificate of advanced study, or doctoral degrees, prospective candidates must meet the appropriate requirements and procedures described herein.

Admission to Graduate Study at the Master's Level

To be admitted to graduate study leading to the master's degree, the applicant must have attained a 2.5* undergraduate grade-point average.

Conditional Admission

Applicants who have attained an undergraduate grade-point average of at least 2.25 but less than 2.5 may be admitted conditionally as "Probationary graduate students"*** in the Division for a period not to exceed the completion of nine graduate hours.

In order to remove his probation the student will be required to have a 2.75 graduate course grade-point average at the end of the semester in which he completes his ninth hour of graduate course work in residence.

*All grade-point averages discussed refer to a four-point system where 4.0 is an "A".

**SPA and C&G do not accept any probationary students.

If the 2.75 graduate course grade-point average is not attained by a probationary student after the ninth hour of WVU graduate course work, he shall not be permitted to continue in the Graduate School in the same program.

Admission to Candidacy for the Master's Degree

To be admitted to candidacy for the master's degree in any of the program areas in the Division of Clinical Studies a prospective candidate must:

- (1) Be classified as a regular graduate student within the chosen program area;
- (2) Submit to the appropriate program area a proposed program of study endorsed by his faculty adviser.

Admission to Candidacy for the Certificate of Advanced Study

The Certificate of Advanced Study (CAS) is regarded primarily as a terminal degree for those qualified individuals who do not plan to pursue the doctorate. As such, it is separate and distinct from the doctoral programs. Therefore, completion of the requirements for the CAS does not necessarily imply that such coursework would be acceptable for a doctoral program should the student subsequently choose to pursue the doctorate.

The broad criteria for the CAS are: an appropriate master's degree or its equivalent with a minimum graduate grade-point average of 3.0. Students interested in the possibility of pursuing the CAS should consult with faculty in the appropriate program areas.

Admission to Graduate Study Leading to the Doctorate

Students interested in pursuing the doctorate are admitted to candidacy in three different phases. The first phase consists of application for admission to the WVU Graduate School using standard procedures. The second phase consists of the Preliminary Examination and formal admission to doctoral study in the program area of the Division. The third phase consists of the Admission to Candidacy Examination. Details of these major steps are available on page 210 under "The Degree of Doctor of Education."

Special Requirements for the Master's Degree in Counseling and Guidance, Reading, and Special Education

1. No student may be awarded a master's degree unless he has a minimum grade-point average of 3.0 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

2. No student may repeat a required graduate course more than once.

3. Fifteen semester hours of approved work in extension may apply toward the completion of degree requirements, if no work is transferred from another institution.

4. No more than six semester hours of approved transfer credit from another institution may be applied toward the degree.

5. No more than nine hours of extension work may be used toward the degree if six hours of transfer credit from another institution is applied toward the degree.

6. Requirements for the master's degree must be completed within a period of seven years.

7. Final examination (oral, written, or both, at the discretion of the candidate's adviser and the Department).

A candidate who fails the final master's degree examination may be given (upon written consent of his advisory committee) a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

Counseling and Guidance (Master of Arts Degree)

General Requirements

I. Admission to Program

- A. Completed application made to: Office of Admissions and Records, WVU.
- B. Minimum 2.5 undergraduate grade-point average.
- C. Bachelor's degree and course work in appropriate areas.
- D. Satisfactory references and personality to indicate success as a counselor.
- E. Contact with adviser by mail or conference prior to registration for courses. (The Counseling and Guidance program requirements are distributed at this time.)
- F. Program planning contract completed with adviser and department.

Students will not be classified as "regular graduate students" until the above requirements have been completed. Applicants who do not meet the above criteria can not be admitted. No students are admitted on probation, and none are admitted to other than degree or certification programs.

The Counseling and Guidance office is located in 504 Forestry Tower; phone (304) 293-2691.

II. Admission to Candidacy

- A. Completion of requirements within Blocks A and B below.
- B. Completion of the Master's Candidacy Preliminary Examination which is part of practicum preregistration. Students must make application for the Master's Preliminary Examination during registration or by midterm prior to the

administration of the examination, which is given the next to last Saturday of each term.

III. Master of Arts Degree and Professional Counselor Endorsement*

- A. Completion of the required (all numbered) courses in Blocks A-I, B and C plus 9 hours approved by the adviser from A-II or;
- B. Completion of the required (all numbered) courses in Blocks A-I, B and C plus 3 hours approved by the adviser from A-II and an approved thesis.
- C. A minimum graduate grade-point average of 3.0.**
- D. Recommendation of the faculty.

Required for West Virginia Certification, not for degree.

- E. A valid professional teaching certificate at the level for which counseling and guidance endorsement is desired.
- F. Two years of successful educational experience in teaching or guidance and counseling or a combination thereof at the level for which an endorsement for counseling and guidance is desired.

IV. Temporary License in Counseling and Guidance: Guidance Workers***

An individual with a valid professional teaching certificate wanting a professional certificate may be granted a *temporary license*, valid for one year, endorsed for serving as a COUNSELOR AT THE LEVEL OF HIS PROFESSIONAL CERTIFICATE provided he:

- A. Secures the recommendation of the superintendent who agrees to employ him.
- B. Submits a plan which has University approval for the completion of the guidance program.
- C. Recommendation at West Virginia University will be made with completion of the following four courses leading to 12 hours of graduate credit:
 1. Basic Course in Guidance (C&G 303).
 2. Theory and Practice of Human Appraisal (C&G 305).
 3. Vocational Development and Occupational Choice (C&G 320).
 4. Theory and Techniques of Counseling (C&G 306).

*While 36 hours represent the minimum academic requirements, proficiency in counseling is the prime criterion for completion of the counseling and guidance program. This may mean that in some cases on the basis of the preliminary exam, practicum performance, and/or comprehensive exam additional course work or experience may be required to meet this level of competency.

Prospective candidates for the Counseling and Guidance program should carefully examine their motives, personal strengths, and weaknesses to determine if limitations in their capacity for intense interpersonal relationships may restrict or impede their acquiring the expected level of counseling proficiency and application of academic and research skills.

**Required for students admitted beginning second semester 1967-68.

***Temporary License in Counseling and Guidance. The temporary license as a Guidance Worker replaces the Counselor Permit as of September 1, 1968.

V. Inclusion of Renewal

The holder of a temporary license endorsed for serving as a counselor may have his license reissued for one year, provided:

- A. He completes, subsequent to the issuance of his last license, six semester hours of graduate credit in courses prescribed for the counselor endorsement.
- B. The graduate institution where he expects to complete his counseling program must:
 - a. verify that the credits earned are prescribed by the West Virginia Board of Education for the issuance of this endorsement;
 - b. recommended the reissuance of the license based upon the applicant's satisfactory performance in his specialization.
- C. The employing superintendent must also:
 - a. certify that the applicant is the best qualified person available;
 - b. recommends the reissuance of the license based upon successful experience.

Course Requirements

Block A Courses

A-I Counseling and Guidance Foundations: (10 hours)

C&G 302—**Human Relationships.** 2 hr.* (S or U)**

C&G 303—**Basic Course in Guidance.** 3 hr.

Stat. 311—**Statistical Methods.** 3 hr. or appropriate substitute.

C&G 320—(or Rehab. 320).—**Vocational Development and Occupational Choices.** 2 hr.

A-II Behavioral Science Foundations Courses: (9 hours)

Courses shall be selected *with the consent of the adviser* from approved electives in the Psych-Socio foundations listed below to complete the (9) hours required in this block. Courses which will be approved in this block are those external to the Department of Counseling and Guidance and designed to better understand human behavior and to supplement counseling. Demonstration of proficiency in the areas of Personality Theory, Learning Theory, and Research will be required to pass the Master's Preliminary Examination. Credit in research is required for certification.

*Hours shown are the minimum requirements. Some 2-hour courses can also be taken for 3 hours of credit.

** (S or U) indicates courses which are graded as satisfactory or unsatisfactory depending on whether the student reaches the required level of proficiency.

Personality Theory***

Learning Theory***

Research***

Advanced Educational

Psychology

Child Development

The Exceptional Child

Adolescent Development

Social Psychology

Mental Hygiene

Anthropology

Economics

Sociology

Abnormal Psychology

Behavior Problems in the

School

Specialized course from area of

concentration, one course

allowed

***Students who may move on into the doctoral program should prepare themselves in depth in these required areas.

Block A-II in conjunction with undergraduate preparation should provide the expected knowledge needed for the Master's Preliminary Examination on personality theories, human growth and behavior, and basic sociological concepts. Skill and knowledge in interpreting research is expected to be developed in each course throughout the sequence. Campbell's *Form and Style in Thesis Writing* will be used as the standard reference of style for preparation of papers; familiarity and competency in its utilization is necessary. The master's thesis should be prepared under the Graduate School regulations on theses and dissertations.

Block B Courses: (6 hours) (PR: Second semester status)

B - I Courses

C&G 305. **Theory and Practice of Human Appraisal.** 3 hr. PR: C&G 303 or proficiency exam in Statistics. Statistics 311 is recorded as PR.

C&G 306. **Counseling Theories and Techniques.** 3 hr. PR: 15 hr. completed including Block A-I by completion of C&G 306, and consent.

B - II Preliminary Examination

The Master's Candidacy Preliminary Examination which can be taken concurrently with C&G 306 must be taken prior to registration for the practicum. This exam, replacing the objective portion of the Master's Comprehensive Examination, will be held on Saturday two weeks before the end of each term. Students must register with the departmental secretary by mid-term prior to the exam. This exam covers the fundamental material from Personality Theory, Learning Theory, and Research; plus material from 302, 303, 305, 306, and 320, which is designed to bring knowledge in the guidance foundations to the criterion level expected of all counselors.

Block C Courses: (11 hours)

C&G 307—Application of Counseling Techniques.* 3 hr. (S or U)

C&G 308—Organization and Development of Counseling and Guidance Services. 2 hr. or appropriate substitute.

C&G 309—Group Techniques in Counseling and Guidance. 2 hr.

C&G 385—Practicum in Counseling. 4 hr. (S or U)

(NOTE: C&G 307 and 385 will be combined with C&G 308 and 309 in the Summer program for the Practicum Block.)

*C&G 307 should be taken concurrently with C&G 306 by fall term students. Summer students will take C&G 307 with the regular Practicum Block (Block C). 308 and 309 are only offered in summer and spring terms.

Special Requirements

1. Students completing their degree under a previous program agreement must meet with their adviser or departmental adviser as soon as possible and *prior* to the day of registration for their next term to define any necessary revisions. Previously *approved* work will be credited; however, the remaining courses must be selected from within the present program offerings with the consent of the adviser.

2. Satisfactory advising cannot be handled at registration time. Students needing advising are required to make an appointment to meet with their adviser or with the departmental adviser prior to the registration period.

3. Courses are sequenced so that full-time resident students should plan to finish Block B in the fall term and Block C in the spring.

4. Admission to practicum during the summer is limited. The probability of admission to practicum is much higher during the Fall or Spring semesters.

5. In the summer of 1969 the status of special student and probationary student was dropped from Counseling and Guidance admissions.

6. Only 9 hours of extension work may be applied to the Master's degree from the Counseling and Guidance program.

7. No more than 9 hours will be credited in extension for any program prior to the completion of 6 hours in residence at the University.

8. No more than 12 semester hours of approved transfer credit from another institution may be applied toward the degree. Transfer course work will be considered from Block A and B excluding 306.

9. No more than 15 hours of combined extension and transfer credit may be used toward the degree.

10. Requirements for the master's degree must be completed within a period of seven years.

11. A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.

12. No student may repeat a required graduate course more than once.

13. At the discretion of the candidate's departmental advisory committee, a final oral exam may be required after the written comprehensive exam.

14. A candidate who fails the final master's degree examination may, upon written consent of his advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

15. Full-time students should begin course work during the summer semester. This will facilitate placement in the important practicum experience.

Counseling and Guidance (Certificate of Advanced Study)

Admissions

1. Completion of a master's degree in *Counseling and Guidance* or equivalent comparable to West Virginia University master's degree in Counseling and Guidance with approved practicum experience.

2. A minimum graduate grade-point average of 3.0.

3. A total score of 1000 on the Graduate Record Examination aptitude test.

4. Personal interview with faculty members in Counseling and Guidance.

5. Demonstration of competency in counseling, measurement, statistics, and the guidance function in education as evidenced by references and appropriate examinations.

6. Evidence of successful appropriate work experience.

7. Written justification for choice in area of specialization.

8. Three references for recommendation.

9. Plan of study approved by assigned adviser.

Areas of Specialization

Elementary School Counseling

Student Personnel Work

Employment Counseling

Pupil Personnel Services

Secondary School Counseling

Correctional Counseling

Research in Counseling

Requirements for Graduation

- A. Completion of 36 semester hours of approved graduate work.
- B. A minimum grade-point average of 3.2 on all course work attempted under the Certificate of Advanced Study Program.
- C. Demonstration of competencies as a specialist in chosen area of specialization.
- D. Recommendation of the department.

Program

- 1. 12 Semester hours core from C&G:
 - 385—Practicum: Advanced—Specialized applications of counseling. 3 hr.
 - 463—Advanced Theories of Counseling. 3 hr.
 - 466—Manpower Utilization and Development. 3 hr.
 - 469—Theory & Practice of Student Appraisal. 3 hr.
- 2. 12 semester hours selected with adviser's consent in specialty area of advanced courses external to the C&G program area.
- 3. 6 hours to achieve competencies in consumption and production of field research.
- 4. 6 hours research problem in area of specialization.

Residency (Minimum)

- A. 1 semester or 2 summers (12 hr.) on campus.
- B. Program completion of 12 hr. extension and transfer, or approved inter-university cooperative program.

Counseling and Guidance (Doctoral Degree — Ed.D.)

The doctoral degree program in Counseling and Guidance is tailored to individual needs; however, it does require extensive academic and practical work which carries the student beyond the minimum limits established in the College requirements for the Ed.D. degree.

Entrance Requirements (Ed.D.)

- 1. Be admitted to the West Virginia University Graduate School.
- 2. Complete a master's degree program in Counseling and Guidance or equivalent. The equivalency should be comparable to the WVU master's degree program.
- 3. No minimum grade-point average has been established for admission to the program, except that established by the Graduate School. It is recommended, however, that the student's graduate grade-point average be in the vicinity of 3.5 on a 4.0 scale.
- 4. Complete the aptitude section of the Graduate Record Examination and have the scores of those tests placed on file in the

office of Counseling and Guidance. It should be stressed that no cut-off score has been established, but most students admitted to the program have a total aptitude score of around 1,000.

5. A personal interview with the faculty in Counseling and Guidance is necessary. If this is not possible, we reserve the right to have the applicant be interviewed by a professor in another institution who can make recommendations regarding his qualifications for doctoral study.

6. At least three references should be submitted to the department of Counseling and Guidance. These references should pertain to the individual's competency in counseling, measurement, statistics, research, etc. The references should also contain information regarding the individual's personal characteristics particularly as they relate to the completion of a doctoral program.

7. The application form for the doctoral program should be completed. It should be stressed that the student should give special attention to the areas included in the application.

8. Upon the completion of all of the above-mentioned steps, the materials will be reviewed by the faculty. Review of materials is usually conducted during the months of February and March and announcements regarding admission are made on or before March 15th. It should be stressed that materials received after March 15th will not be reviewed until the following year. All students not enrolling for courses during the year following admission must reapply prior to taking course work.

The Qualifying Examination

Near the end of the first year of course work, the doctoral student should take the qualifying examination. The purpose of this examination is twofold—screening and diagnostic.

The qualifier is to be composed of two parts—a written and oral section. The written part of the examination is broken down as follows:

- a. theory of counseling
- b. group dynamics
- c. occupational information
vocational choice theories
research regarding vocational choice theory
- d. measurement theory and practice
- e. professional issues
- f. research
- g. sociology and psychology foundations

In the oral part of the examination the student is asked to demonstrate a practical skill.

The Comprehensive Examination

The comprehensive examination, as viewed by the Counseling and Guidance faculty, has as its major purpose the assessment

of the student's ability to synthesize the divergent material which he has learned in the doctoral program.

The length of the comprehensive examination shall be comprised as follows:

a. departmental examination.....	6 hours
b. special area examination.....	6 hours
c. minor examination	6 hours
d. oral examination.....	2 hours

Admission to Candidacy and Dissertation

When a student has successfully completed his comprehensive examinations, the graduate school is informed and he is formally admitted to candidacy for the doctoral degree. Upon admission to candidacy, the student has a number of steps to complete:

1. A prospectus regarding the student's research should be prepared and approved.
2. The student may, after acceptance of his prospectus, begin to carry out the research which he has proposed.
3. Upon completion of the research, the data must be analyzed and the dissertation prepared.
4. The student should then schedule the defense of this dissertation.

Counseling and Guidance

C&G

216. **Behavior Problems and the School.** I, II, S. 3 hr. Emphasis on the identification and understanding of students with special needs in the areas of social, emotional, and learning problems and in developing remedial programs for these students leading to more satisfactory adjustment within the school situation.
283. **Workshop in Counseling and Guidance.** I, II, S. 1-12 hr. PR: Consent To take care of credits for special workshops and short intensive limit courses on methods, supervision and other special topics.
302. **Human Relationships.** I, II, S. 2-3 hr. Experientially based learning model which focuses on group processes and procedures. Designed to provide self-screening opportunities for prospective counselors. Includes a weekend learning laboratory.
303. **Basic Course in Guidance.** I, II, S. 3 hr. An overview of a total guidance program covering the philosophical, sociological, and psychological foundations of a counseling program, and study of the major theories of vocational choice. A mandatory requirement of 10 hours in either a laboratory or fieldwork experience is required.
305. **Theory and Practice of Human Appraisal.** I, II, S. 3 hr. PR: C&G 303 or proficiency in statistics and consent. Comprehensive study of all objective measures used in schools; techniques of administering and interpreting tests to individual and groups; developing testing programs and costs. Laboratory experience required to develop proficiency in administration, scoring and interpretation of selected tests.
306. **Counseling Theory and Techniques.** I, II, S. 3 hr. PR: C&G 303, 305, 320. Seminar study of counseling techniques with coverage of major classical and contemporary theories.

307. **Application of Counseling Techniques.** I, II, S. 3 hr. PR: C&G 303, 305, 306, 320. Clinical consideration of identification, causes and development of psychological maladjustments, further study of developments in counseling with role play and counseling under supervision.
308. **Organization and Development of Counseling and Guidance Services.** II, S. 2 hr. PR: C&G 303, 304, 305, 306. Operation of guidance program in terms of personal functions, relationships, physical facilities, instructional integration, financial standards, law and regulations.
309. **Group Counseling Theory and Techniques.** II, S. 2-3 hr. PR: C&G 306, 307. A comprehensive coverage of theories of group counseling and demonstrations of specific group techniques for advanced Master's and Certificate of Advanced Studies candidates in Counseling and Guidance.
310. **Introduction to Student Personnel Work in Higher Education.** I. 3 hr. PR: Consent. A historical and topical study of the development of student personnel structure and functions in higher education, including an examination of goals and objectives in light of current social forces and relevant research.
320. (or Rehab. 320). **Vocational Development and Occupational Choices.** I, II, S. 2-4 hr. PR: C&G 303. Methods of gathering and disseminating occupational and educational information.
330. **Elementary School Guidance.** I, S. 3 hr. PR: Consent. Practical application of the principles of guidance to the elementary school.
382. **Special Topics.** I, II, S. 1-6 hr. PR: Advanced standing and consent. Independent study and directed readings in specialized areas of counseling and guidance.
385. **Practicum.** I, II, S. 1-12 hr. PR: Preregistration, cleared for graduation at close of term, or M.A. degree. An intensive supervised practical experience in the public schools in counseling with individual critique and appropriate small group experiences.
395. **Problem in Counseling and Guidance.** I, II, S. 1-12 hr. PR: Consent. Study and research for master's degree in Counseling and Guidance.
431. **Practice of Elementary School Counseling and Guidance.** I, II, S. 4 hr. PR: C&G 330 and consent. A specialized multiple training experience covering advanced theory, techniques and practices, skill development in teacher consulting, analysis of classroom climate, and competence to deal with the typical problems encountered by the counselor in the elementary school.
463. **Advanced Theories of Counseling.** I, S. 3 hr. PR: Practicum in counseling, admission to advanced graduate study, and consent. A comprehensive study of the theoretical issues in contemporary counseling.
464. **Individual Intelligence Testing and Interpretation.** I. 4 hr. PR: Advanced graduate standing and preregistration with instructor (9 hr. psychology and demonstration of proficiency in measurement needed for admission). Techniques in administering, scoring, and interpreting individual mental ability tests.
466. **Manpower Utilization and Development.** II. 3 hr. PR: Advanced standing and consent. A consideration of the economic, social, and political implications of manpower utilization and the role the counselor must undertake to assist society with its ever pressing demands.
469. **Advanced Theory and Practice of Human Appraisal.** II, S. 3 hr. PR: Statistics 311, C&G 305, and consent. Analysis of and supervised practice

in the use of major standardized and local assessment instruments typically used in vocational and educational guidance and counseling. Included also are factors in the management and development of coherent testing programs.

- 472. **Internship in Student Personnel Work.** I, II. 1-12 hr. PR: C&G 310 and admission to Certificate of Advanced Studies or doctoral program in Counseling and Guidance. The course is designed to offer advanced graduate students an opportunity to practice under close supervision the professional skills required in the broad field of student personnel work in higher education.
- 480. **Seminar.** I, II, S. 1-6 hr. PR: Advanced graduate standing and consent. Seminar for Certificate of Advanced Studies and doctoral students in Counseling and Guidance.
- 497. **Research.** I, II, S. 1-15 hr.

Reading

Graduate students with successful teaching experience at the elementary, secondary, or college levels, or those who desire to enter these fields, may wish to increase their competence as teachers of reading, to keep informed of latest trends and developments in the field of reading, or to advance to positions of greater responsibility. To meet the needs of such students, the Department of Reading offers graduate programs leading to a Master of Arts degree in reading, a post-master Certificate of Advanced Study, and the Doctor of Education degree with a major in reading. Completion of these advanced programs may lead to certification as reading specialists.

Course offerings provide opportunities to become familiar with the organization, implementation, and administration of developmental and remedial reading programs for students at the elementary, secondary, and college levels. Advanced students of superior academic and professional background find in these programs opportunities to participate in clinical work, to become involved in research, and to prepare for positions in public and private schools at elementary, secondary, and college levels, as well as for related positions in industry and business.

Programs for graduate study are worked out individually with each student. Course requirements depend upon previous academic background and experience and the position for which the student wishes to prepare.

Certification in Reading*

Two licenses for teaching reading are available to West Virginia teachers: a temporary endorsement and an endorsement as a Reading Specialist.

*Students who desire reading certification in states other than West Virginia should consult with their adviser relative to requirements.

Temporary Endorsement. Six (6) semester hours of graduate credit in reading courses are needed for temporary endorsement as a reading teacher. The areas of concentration and approved courses are:

I. Foundations of Reading Instruction—(3 hr.): Rdng. 321—Reading for Classroom Teachers; Rdng. 322—Reading Instruction in Secondary Schools; or Rdng. 324—Psychological Foundations of Reading Instruction.

II. Diagnosis and Correction of Reading Difficulties—(3 hr.): Rdng. 283—Workshop: Remedial Reading (Extension Course); or Rdng. 340—Corrective Techniques in Reading Instruction.

III. Clinical Reading—(3 hr.): Rdng. 341—Problems in Clinical Reading; or Rdng. 444—Advanced Clinical Reading.

Reading Specialist Endorsement. Twenty-seven (27) semester hours of graduate credit are needed for a Reading Specialist endorsement—fifteen (15) semester hours with credit in each area named in Group A, and twelve (12) semester hours with credit in each area named in Group B. The areas of concentration and approved courses are outlined below:

I. Course Requirements

Group A (15 semester hours)

Foundations of Reading Instruction (6 hr.)

Rdng. 321—Reading for Classroom Teachers OR

Rdng. 322—Reading Instruction in Secondary Schools

Rdng. 324—Psychological Foundations of Reading Instruction

Diagnosis and Correction of Reading Difficulties (3 hr.)

Rdng. 283—Workshop: Remedial Reading

Rdng. 340—Corrective Techniques in Reading Instruction

Rdng. 442—Diagnosis of Reading Difficulties

Rdng. 443—Correction of Reading Difficulties

Clinical Reading (Laboratory Experiences) (3 hr.)

Rdng. 341—Problems in Clinical Reading

Rdng. 444—Advanced Clinical Reading

Planning and Organizing a Reading Program (3 hr.)

Rdng. 283—Workshop: Organizing the Reading Program

Rdng. 326—The Organization, Administration, and Supervision of the Reading Program

Group B (12 semester hours)

Measurement and/or Evaluation (3 hr.)

Ed. Psych. 330—Advanced Educational Measurements

Rdng. 480—Seminar: Measurement and Evaluation in the Language Arts

Human Development (3 hr.)

Psych. 243—Child Behavior

Spec. Ed. 250—Survey of Exceptional Children and Adults

Psych. 282—Exceptional Children

- Ed. Psych. 440—Human Development and Behavior
- C&G 216—Behavior Problems in the School
- Soc. 221—Sociology of Childhood
- Psychology of Personality and/or Mental Hygiene (3 hr.)
- Soc. 252—Culture and Personality
- Psych. 263—Introduction to Personality
- Psych. 264—Psychology of Adjustment
- Psych. 281—Abnormal Psychology
- Educational Psychology (3 hr.)
- Ed. Psych. 391—Problem in Educational Psychology
- Psych. 423—Human Learning
- Ed. Psych. 450—Psychological Foundations of Learning
- Ed. Psych. 451—Principles of Instruction

II. Additional Requirements

- A. A valid professional teaching certificate or its equivalent
- B. Three years of successful experience as a classroom teacher
- C. A master's degree in reading or classroom teaching
- D. Recommendation of the College for a Reading Specialist Certification

Master of Arts Degree (Reading)

I. Admission to Program

- A. Accepted to graduate study by the Office of Admissions and Records, West Virginia University
- B. Minimum 2.5 undergraduate grade-point average, or a minimum Graduate Record Aptitude Examination score of 400 (verbal), and acceptance by the Reading Department.
- C. Contact with Department of Reading by mail or conference prior to registration for courses
- D. Applicants who do not meet the above criteria may be given probationary admission
- E. Students must complete 6 or more hours in reading within two years after admission (probationary or regular) or admission will be invalidated and the student will be required to reapply.

II. Admission to Candidacy

- A. Admission to program as regular graduate student.
- B. Completion of 12 hours of course work, 9 of which must be taken on campus.
- C. A grade-point average of 3.0 or better in the above 12 hours of course work.
- D. Proof of successful teaching or acceptable clinical experience.

III. Program Requirements

- A. Program A—Completion of a minimum of 30 hours (21 required and 9 elective hours, 3 of which must be in Reading). Program A requires the completion of a problem or thesis.
- B. Program B—Completion of a minimum of 36 hours (21 required and 15 elective hours, 6 of which must be in Reading).
- C. Credit Limitations
 - 1. No more than 12 hours of graduate credit obtained at other approved institutions may be considered for transfer.
 - 2. No more than 15 hours of extension credit or combination of extension and transfer credit may be counted toward the master's degree.
 - 3. No more than 9 hours in extension may be obtained before completing at least 6 hours on campus.
 - 4. No more than 6 hours of the required 15 hours of reading courses may be completed in extension.
 - 5. Written approval from the adviser prior to enrollment is necessary before transfer credit can be counted.
- D. Successful experience as a classroom teacher or acceptable clinical experience.
- E. A minimum grade-point average of 3.0 is required for graduation.
- F. Successful completion of the written and/or oral Master's Comprehensive Examination.

IV. Course Requirements

A. Required Courses	Program A	B
Ed. Psych. 391*	0	3
C&I 301 or 304.....	0	3
Ed. Psych. 320.....	3	0
Rdng. 321* or 322*.....	3	3
Rdng. 324*	3	3
Ed. Psych. 330* or Rdng. 480*	3	3
Rdng. 340*	3	3
Rdng. 341*	3	3
Rdng. 495.....	3	0
	<hr/> 21	<hr/> 21

*Courses marked with an asterisk (or their equivalent in the list of courses required for certification in reading) are required for an endorsement as a Reading Specialist in West Virginia.

B. Electives	9	15
Rdng. 283, 330, 331, 325, 326,* 442, 443, 444, 480, 481, 485		
Psych. 243,* 263,* 264, 281, 282, 423		
Ed. Psych. 440, 450,* 451		
C&G 216, 302, 305		
Ed. Admin. 331		
Speech 275		
SPA 250		
Sp. Ed. 250, 255, 260, 306, 480		
Soc. 221, 252		
Total.....	30	36

Certificate of Advanced Study in Reading

The program for the Certificate of Advanced Study in Reading is designed to develop individuals who possess advanced knowledge and professional skill in the language arts area and who can and will assume leadership positions in educational systems.

I. General Requirements

- A. Complete the general requirements for admission to the Graduate School of WVU.
- B. Present at the time of application, proof of a master's degree from an accredited university.
- C. Have a minimum grade-point average of 3.0 on all work completed for the master's degree.
- D. Verify the completion of a minimum of three years of teaching or related experiences.
- E. Plan, with the aid of a CAS committee, a total program of 30 graduate credits, including a 6-hour research project.
- F. Complete a residency requirement of 18 semester hours.
- G. Meet all requirements for a Reading Specialist Certificate.
- H. Maintain an average of 3.0 or above on all course work.
- I. Pass an oral examination on the research project and on all courses taken in Reading.
- J. Meet all the above requirements within the *five* calendar years immediately preceding the award of the Certificate of Advanced Study.

II. Course Requirements (30 hours)

	Hr.
A. Reading (selected from the following)	15
Rdng. 325—Survey of Major Problems in Reading	3
Rdng. 332—Survey of Major Prob. in the	
Language Arts.....	3
Rdng. 442—Diagnosis of Reading Difficulties.....	3

Rdng. 443—Correction of Reading Difficulties	3
Rdng. 444—Advanced Clinical Reading.....	3
Rdng. 480—Seminar.....	3
Rdng. 481—Special Topics.....	1-6
Rdng. 485—Practicum.....	1-12
Rdng. 497—Research (6 hours required).....	1-15

B. Electives (reading or related courses)..... 9

Selected by adviser and student to meet individual needs and certification requirements.

Reading majors at the CAS level who have not completed prerequisites for the courses selected should plan to do so as additional academic requirements for the degree *unless the courses are waived*. Prerequisites may be *waived by consent of the adviser and Reading Center faculty* if in their opinion the student has had background experiences in reading which are equivalent to those provided by the courses listed in this catalog as prerequisites.

The Degree of Doctor of Education (Reading)

The doctoral program in Reading is highly individualized. As such, the reading curriculum for a concentration at the doctoral level cannot be prepared in advance. Courses will depend upon the student's background, experience, courses completed at the master's level, and the post-doctoral objectives of the individual. Reading courses to be completed at another institution must receive prior approval by the student's doctoral committee.

Students who desire to complete the Doctor of Education degree with a concentration in reading must meet the following standards:

I. Admission to Program Requirements

- A. Complete all graduate school and college requirements for admission to graduate study at the doctoral level.
- B. Show evidence of a minimum graduate grade-point average of 3.2 or higher on a 4-point scale. Consideration will be given to students who are below a 3.2 cumulative graduate grade-point average only after (1) an oral interview with the Reading Center faculty, (2) completion of a minimum of nine hours of residence credit in reading, and (3) review of recommendations and all other criteria pertinent to admission.
- C. Provide the Reading Center with the following:
 1. GRE, MAT, or other mental ability ratings acceptable to the Reading Center faculty.
 2. Transcripts of all college work.
 3. Three or more letters of recommendations.
 4. Evidence of teaching or other acceptable experiences.
 5. A vita which shows practical work experiences.

- D. Complete at least nine hours of post-master's courses in reading, all to be taken at WVU, prior to an oral interview.
- E. Successfully complete an oral interview with the Reading Center faculty-student committee.

II. Program Completion Requirements

After the doctoral student has successfully completed all of the above admission requirements, the following steps should be taken in cooperation with his adviser.

- A. Complete a departmental examination on reading for program planning purposes.
- B. Plan with the adviser the selection of a doctoral committee.
- C. Meet with this committee to complete program planning.
- D. Plan with the aid of the Doctoral Committee, a satisfactory program with a minimum of 24 semester hours in reading.
- E. Complete a residency requirement of at least one academic year (18 semester hours).
- F. Maintain an average of 3.0 or above on all course work.

III. Admission to Candidacy and Graduation Requirements

- A. Pass the Admission to Candidacy Examination satisfactorily.
- B. Prepare a suitable dissertation, with committee approval, on some phase of reading or language arts.
- C. Pass the final oral examination successfully.
- D. Present suitable printed copies of the dissertation to the Chairman of his Doctoral Committee, the Reading Department, the Graduate School, and to other University agencies which might require copies.

Reading

Rdng.

- 283. **Special Workshop in Reading.** I, II, S. 1-6 hr. A course designed for both elementary and secondary students in preservice education programs, as well as for elementary and secondary teachers in inservice education.
- 321. **Reading for Classroom Teachers.** I, II, S. 3 hr. A basic course in teaching reading, grades 1-12. It is planned to give students who have little or no background in reading an opportunity to study the reading process and to learn how to apply effective techniques and methods to classroom teaching of reading.
- 322. **Reading Instruction in the Secondary Schools.** I, II, S. 3 hr. A study of the reading skills essential at the high school level and how they may be developed in the various subject matter areas.
- 324. **Psychological Foundations of Reading Instruction.** I, S. 3 hr. A course which is principally concerned with the physiological, psychological, and sociological factors underlying the development of reading skills. The

course is intended for majors in education, reading, guidance, special education, speech, and other areas whose specialties require an understanding of the reading process.

- 325. **Survey of Major Problems in Reading.** II, S. 3 hr. PR: Rdng. 321 or 322 and 324. An advanced course in the major problems confronting the teacher or supervisor of reading instruction. Essentially a research course in which each student will have the opportunity to complete an individual problem in an area of special interest.
- 326. **The Organization, Administration, and Supervision of the Reading Program.** I, II, S. 3 hr. PR: Rdng. 321, 324. Stresses current practices and procedures in organizing reading programs in all types of schools, grade 1 through college.
- 330. **Teaching the Language Arts.** I, S. 3 hr. A study of the interrelationship among the different phases of the language arts. Special attention is given to organizing the language arts program, selecting materials and equipment, and understanding effective techniques and methods for teaching listening, oral language, written language, handwriting, and spelling.
- 331. **Selection and Evaluation of Reading Materials.** I, S. 3 hr. PR: Rdng. 321. A survey of critical reading skills, techniques, and procedures with emphasis on the selection of supplementary materials needed for effective developmental and remedial reading programs.
- 332. **Survey of Major Problems in the Language Arts.** II, S. 3 hr. PR: Rdng. 330 or consent. An advanced course covering the major problems confronting the teacher or supervisor of language arts instructor. Essentially a research course in which each student will complete an individual problem in an area of special interest.
- 340. **Corrective Techniques in Reading Instruction.** I, II, S. 3 hr. PR: Rdng. 321 or 322 and 324. A basic course in corrective reading for classroom teachers. Special emphasis is given to the correction of reading difficulties by classroom teachers with equipment and materials available to the average classroom.
- 341. **Problems in Clinical Reading.** I, II, S. 3 hr. PR: Rdng. 340. A laboratory course in remedial reading. Major emphasis will be placed upon tutoring remedial cases in the Reading Center.
- 442. **Diagnosis of Reading Difficulties.** I, S. 3 hr. PR: Rdng. 340. Advanced instruction in diagnosis. Emphasis will be placed upon the use of standardization tests, informal tests, machines, and observation in determining the cause of reading difficulties.
- 443. **Correction of Reading Difficulties.** II, S. 3 hr. PR: Rdng. 442 or consent. Advanced instruction in the correction of reading difficulties. Major emphasis will be placed upon methods of teaching, the use of machines and commercial materials, constructing and using teacher-made exercises, and evaluating progress.
- 444. **Advanced Clinical Reading.** I, II, S. 3 hr. PR: Rdng. 341. An advanced laboratory course in remedial reading. Major emphasis will be placed upon the diagnosis and treatment of reading difficulties caused by specific learning disabilities.
- 480. **Seminar.** I, II, S. 1-6 hr. PR: Consent. A seminar stressing the interrelationships among the language arts; mental, physical, and psychological deterrents to language development; needed research in languages arts; and similar topics.

481. **Special Topics.** I, II, S. 1-6 hr. PR: Admission to the doctoral program in reading and consent. An advanced seminar for doctoral students. Considers the weaknesses and strengths in current reading programs, needed research in reading, and suggestions for improving reading instruction at the elementary, secondary, and college levels.
485. **Practicum.** I, II, S. 1-12 hr. PR: Consent. Stresses practical application of reading theory to organizing and conducting developmental and remedial reading programs.
495. **Problem in Reading.** I, II, S. 3 hr. Research for Master's degree in Reading.
497. **Research.** I, II, S. 1-15 hr.

Rehabilitation Counseling

The program in Rehabilitation Counseling offers a graduate curriculum designed to prepare professional counselors to work in a wide variety of rehabilitation settings, including public and private rehabilitation agencies, rehabilitation centers, sheltered workshops, hospitals, and similar facilities. The program prepares the counselor to contribute effectively as a member of a professional team through his understanding of human behavior, his knowledge of rehabilitation concepts, his utilization of effective counseling, and a knowledge and application of rehabilitation evaluation techniques. The counselor must also have developed skill in coordinating services to meet the needs of handicapped persons.

Admission

The applicant must meet admission requirements of the Graduate School and the Program Admissions Committee. A broad liberal arts background is preferable; however, an applicant must have earned a minimum of 6-9 semester hours in courses related to the dynamics of human behavior as a prerequisite to unconditional acceptance as a full-time degree candidate. In addition, each applicant must successfully complete personal interviews with the program faculty and achieve acceptable scores on the program entrance examination.

Requirements for Completion

The degree of Master of Science with a major in Rehabilitation Counseling is conferred by the University upon those students who satisfactorily complete the requirements established by the Graduate School, including the following requirements:

1. Completion of graduate courses approved by the Rehabilitation Counseling Program totaling no fewer than 42 semester

hours with a 3.0 grade-point average. In most cases, the total program will range between 42 and 48 semester hours.

2. Completion of 10 to 12 semester hours of supervised clinical practice under faculty direction in a rehabilitation setting.

3. Demonstration of competence in the theoretical and applied aspects of rehabilitation counseling to the satisfaction of the Faculty Committee in charge of the program. This will include passing a comprehensive examination, oral, written, or both, at the discretion of the Committee. A project will be required. A degree will not be awarded solely on the basis of credits earned. A candidate must also demonstrate, as he proceeds in the program, the ability to assume the degree of responsibility required of a professional counselor, and the personal characteristics essential to effective working relationships with others.

Curriculum

The choice of courses comprising the program will be determined by an evaluation of the needs of the individual student. The student's program is then supplemented by other courses offered in rehabilitation or by appropriate electives selected from other programs and departments. In all cases, courses are selected by the student with the consent of his adviser.

Rehabilitation Counseling

Rehab. Counsel.

300. **Introduction to Rehabilitation Services.** I, II. 2 hr. PR: Junior standing and 15 hr. in social science or education or consent. A study of the processes by which certain human conditions may be ameliorated by social and vocational rehabilitation services, in particular, counseling and evaluation. Emphasis upon historical survey, philosophy and concepts of rehabilitation and case service techniques to assist individuals with physical, mental, and/or social handicaps.
310. **Medical Aspects of Rehabilitation.** I, II. 3 hr. PR: Junior standing and 15 hours in social science or education or consent. A study of the medical needs of handicapped persons in the rehabilitation process from time of referral through placement and case closure.
312. **Psychological Aspects of Disability.** I, II. 3 hr. PR: Graduate standing and consent. A study of the psychodynamics of adjustment to atypical physique and prolonged infirmity. Includes a study of somatopsychology.
314. **Special Problems in Rehabilitation.** I, II. 1-3 hr. PR: Graduate standing and consent. Rehabilitation theory and techniques in problems such as blindness, epilepsy, and mental retardation. Course also provides for concentrated study in special institutes.
320. **Vocational Development and Occupational Choices.** I, II. 3 hr. PR: Graduate standing in social sciences or education. A study of vocational development theory, occupational choice, problems of maturation and work attitudes, techniques of job evaluation, and socio-economic implications of a changing occupational structure.

374. **Field Work in Rehabilitation.** I, II, S. 1-6 hr. PR: Consent. Supervised field work experience in rehabilitation settings to provide rehabilitation counseling students with a more adequate orientation to their profession.
462. **Clinical Conference in Rehabilitation.** I, II, S. 3 hr. PR: Graduate standing and consent. An analysis and integration of the clinical methods essential to facilitating the rehabilitation process.
472. **Counseling Practicum.** I, II. 3 hr. PR: Graduate standing and consent. Supervised experience in the application of counseling techniques in the rehabilitation process.
475. **Clinical Practice.** I, II, S. 1-12 hr. PR: Consent, following at least one academic semester in classroom. Clinical practice (internship) in selected agencies, rehabilitation centers, clinics, or hospitals conducting an organized program of services for the physically, mentally, emotionally, or socially handicapped. Such practice will be under direct supervision of faculty and agency personnel.
480. **Seminar.** I, II, S. 1-12 hr. PR: Consent. Administration of programmatic research; legal and ethical issues in research and service programs, etc.
481. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. Contemporary issues in the behavioral sciences and rehabilitation.
482. **Workshop in Rehabilitation.** I, II, S. 1-12 hr. PR: Consent. Supervision in the counseling process; vocational evaluation in rehabilitation; utilization of rehabilitation research; contemporary issues in rehabilitation.
497. **Research.** I, II, S. 1-15 hr.

Special Education

The Special Education programs at the master's degree level are designed to prepare master-clinical teachers of mentally retarded children and/or to provide initial training for the preparation of future supervisors and administrators of public school special education programs.

The post-master special education programs leading to the Certificate of Advanced Study and the Doctor of Education are individually prescribed programs. These programs are basically designed to prepare supervisors, administrators, and researchers. The advanced training of graduates who major in special education at the doctoral level prepares them for positions in higher education.

Curriculum for Special Education

Degree: Master of Arts (36 Semester Hours Minimum)

Hours

A. Core Area Requirements (12 Semester Hours in All Master Degree Programs)

Sp. Ed. 250—Survey of Exceptional Children & Adults.....	3
C & G 305—Theory and Practice of Human Appraisal.....	3
Psych. 281—Abnormal Psychology OR	

Psych. 263—Introduction to Personality	OR	
Psych. 264—Psychology of Adjustment.....		3
SPA 342—Advanced Speech Pathology.....		3

B. Teaching Certification MR Area Requirements (15 to 18 Semester Hours)

Sp. Ed. 255—Introduction to Mental Retardation	3
Sp. Ed. 260—Curriculum and Methods for Educable MR	3
Sp. Ed. 305—Mathematics for the MR.....	3
Sp. Ed. 306—Reading for MR Children	3
Sp. Ed. 487—Practicum	3-6
Elective Requirements	6-9

C. Problem or Thesis Area Requirements (9 to 12 Semester Hours)

Sp. Ed. 395—Problem in Special Education	OR	
Sp. Ed. 497—Research		3-6
Sp. Ed. 480—Seminar		3
Stat. 311—Statistical Methods	OR	
Ed. Psych. 320—Introduction to Research		3
Elective Requirements		12-15

D. Approved Electives

C & G 305, 464
C & I 330, 438
Ed. Found. 320, 340
Ed. Psych. 320, 330, 343, 440, 450, 451
P.E. 276
Psych. 263, 264, 271, 281, 282, 322, 423
Rdng. 283, 321, 324, 325, 330, 331, 340
Sp. Ed. 262, 265, 280, 281, 305, 306, 365, 381, 395, 480, 487, 496
Stat. 311, 312

Special Education

Sp. Ed.

250. **Survey of Exceptional Children and Adults.** I, II, S. 3 hr. PR: Consent. Introduction to all areas of exceptionality. Topics surveyed include definition, psychological and educational characteristics, and social and vocational adjustment.
255. **Introduction to Mental Retardation.** I, II, S. 3 hr. PR: Consent. Consideration of historical, etiological, social, educational, and vocational aspects of mental retardation.
260. **Curriculum and Methods for the Educable Mentally Retarded.** I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Organization of instruction, adaptation of teaching methods in the several curricula areas and the construction of materials.
262. **Curriculum and Methods for the Trainable Mentally Retarded.** I, II, S. 3 hr. PR: Sp. Ed. 250, 255 and/or consent. Analysis of special problems of curriculum development for the trainable child and adult and provisions for development of original construction of curricula materials.
265. **Industrial Arts in Special Education.** II, S. 3 hr. Experimentation with industrial arts and crafts suitable for instruction in special education

classes. Discussion of factors involved in selection and manipulation of such media as leather, plastics, ceramics, wood, and metal.

271. **Curriculum, Materials, and Methods for Mentally Gifted.** I, II, S. 3 hr. History and philosophy, identification, curriculum, materials and methods of working with mentally gifted.
280. **Student Teaching Clinical Experience in Special Education.** I, II, S. 1-6 hr. PR: Consent. Student teaching with the mentally retarded.
281. **Special Problems and Workshop in Special Education.** I, II, S. 2-4 hr. PR: Consent. To take care of credits for special workshops and short intensive unit course on methods, supervision, and other special topics.
305. **Mathematics for the Mentally Retarded.** I, S. 3 hr. PR: Consent. Materials and methods for teaching mathematics to the mentally retarded child.
306. **Reading for Mentally Retarded Children.** I, S. 3 hr. Designed especially for majors in Special Education. Emphasizes the techniques, methods, and materials most effective for teaching reading to mentally retarded.
365. **Administration and Supervision of Programs for Exceptional Children.** I, II, S. 3 hr. PR: Consent. Administration and supervision with attention to: selection and placement procedures; facilities and equipment; local, state, federal legislation; and philosophy and recent research.
381. **Special Topics.** I, II, S. 1-6 hr. PR: Consent. Special topics or research in mental retardation and in exceptional children and adults.
395. **Problem in Special Education.** I, II, S. 3 hr. Research for Master's Degree in Special Education.
480. **Seminar.** I, II, S. 1-6 hr. PR: Consent. Special topics concerned with the educational, sociological, and psychological aspects of mental retardation.
487. **Practicum.** I, II, S. 1-12 hr. PR: Consent. Internship, advanced student teaching, and administration and supervision practicum.
496. **Project in Special Education.** I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Special Education.
497. **Research.** I, II, S. 1-15 hr.

Speech Pathology and Audiology

Master of Science in Speech Pathology and Audiology

Applicants who possess a bachelor's degree from an accredited college or university may be admitted to a program leading to candidacy for the degree of Master of Science in Speech Pathology and Audiology, provided that they:

1. Present evidence of ability to pursue graduate work successfully as measured by Graduate School and Divisional standards for admission.

2. Attain an overall grade-point average of 2.75 or above on a 4.0 scale as evidenced by an official transcript. This transcript must be made available to the Office of Admissions and Records and the Speech Pathology-Audiology Graduate Student Acceptance Committee. Any deficiencies in undergraduate preparation will be

made up either without credit or for additional credit required for the Master of Science degree.

3. Provide evidence of the personal qualities predictive of professional success through written letters of recommendation by three individuals in the academic community. These letters must be submitted to the Office of Admissions and Records with copies to the Speech Pathology-Audiology Graduate Student Acceptance Committee.

Deadlines for submitting applications and the material requested in items 1-3 are March 1 for the summer and fall semesters and November 1 for the spring semester. No student will be accepted on a provisional or probationary basis.

Of the applicants under consideration, the Speech Pathology-Audiology Graduate Student Acceptance Committee will accept those whom they believe will meet with success in the graduate program. The number of applicants accepted will depend upon the number of qualified applicants, the size of the Speech Pathology-Audiology graduate faculty, and the facilities available for acceptable academic, clinical, and research training.

Once the student has taken 15 academic hours of Speech Pathology-Audiology graduate courses, his academic and professional performance will be evaluated by the Speech Pathology-Audiology faculty. If his academic average is below 3.0 or if he has more than five semester hours of C or below, he will be dismissed from the program with no probationary status.

Requirements for completion of the Master of Science degree in Speech Pathology-Audiology are:

1. A minimum of 36 semester hours of approved graduate courses in speech and hearing sciences, speech pathology, audiology, and other related areas as may be required to attain professional competence. The student may elect to take up to 6 semester hours of thesis credit in attaining the 36-hour minimum. The student must achieve not less than a 3.0 average for all courses taken for credit toward the graduate degree.

2. Successful performance on written and oral comprehensive examinations according to Graduate School and Divisional standards.

3. Demonstration of professional competence in speech and/or hearing as measured by fulfillment of the academic and practical requirements established by the faculty.

Doctor of Education in Speech Pathology and Audiology

Placed under temporary moratorium by the Program Faculty for an indefinite period, effective January 1, 1968.

Speech Pathology and Audiology

SPA

220. **Introduction to Audiology.** I. 4 hr. PR: Consent. A study of the gross anatomy and physiology of the auditory mechanism; the physics of

acoustic signal production; and an introduction to basic audiometric techniques and interpretation.

222. **Hearing Conservation.** I. 2 hr. PR: SPA 220 or consent. An investigation of trauma (varied) on auditory sensitivity and acuity; identification audiometry; and approaches to hearing conservation.
223. **Aural Rehabilitation.** II. 3 hr. PR: SPA 220 or consent. A survey of the rehabilitative approaches to management in the auditorially handicapped individual. The medical, audiological and social aspects of rehabilitation will be stressed. Procedures of speech reading and auditory training will be examined and evaluated.
250. **Survey of Oral Communication Disorders.** II. 3 hr. PR: Consent. A survey of basic concepts and principles of the disorders of speech and their treatment. Primary attention is given to the more common speech deviations. Students observe examination and corrective methods of therapists in the clinic and schools. Normal speech and hearing development of children is considered. This is an orientation course for students majoring in speech as well as teachers, school administrators, psychologists, and rehabilitation workers.
251. **Advanced Speech Correction.** II. 3 hr. PR: SPA 156. Study of the speech-retarded child and organically based speech disorders including cleft palate, cerebral palsy, esophageal speech, and phonation.
252. **Stuttering.** I. 3 hr. PR: SPA 156. Theories and therapies of stuttering.
253. **Profound Organic Speech Disorders.** II. 3 hr. PR: SPA 251 or consent. Speech and language disorders related to cerebral injury. Emphasis on aphasia and aphasia therapeutics. Differential diagnosis of children with delayed speech and language.
263. **Preschool Deaf Child.** I, S. 3 hr. PR: SPA 157. Emphasis on the importance of early detection and education, the language development of the congenitally deaf child, and the parents' role in early childhood education.
281. **Special Topics.** I, II, S. 1-3 hr. per sem. (Max. credit 6 hr.). Independent study of topics in speech pathology, audiology, and speech and hearing sciences.
282. **Clinical Practice in Speech.** I, II. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of speech disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)
283. **Clinical Practice in Hearing.** I, II. 1-6 hr. PR: Consent. Supervised diagnosis and therapy of hearing disorders. (May be taken for a maximum of 3 semester hours per semester of undergraduate or graduate credit.)
321. **Structure and Function of the Auditory System.** I. 3 hr. PR: Consent. A detailed study of the gross and microscopic anatomy of the auditory system, and a detailed investigation of the physiological aspects of auditory sensitivity and acuity.
322. **Audiology and Audiometry.** I. 3 hr. PR: SPA 220 or equiv. A study of the various audiological techniques that are utilized in the differential

- diagnosis of auditory dysfunctioning. Administration and interpretation of diagnostic techniques.
323. **Bone Conduction Audiometry.** II. 3 hr. PR: SPA 321, 322. An advanced consideration of the anatomical and physiological mechanisms involved in the transmission of acoustic signals through the skull, and the audiological problems in clinical bone conduction audiometry.
 324. **Speech Audiometry.** I. 3 hr. PR: SPA 321, 322. The basis for the application of hearing for speech tests in assessing communication systems. Analysis of auditory processing of complex signals and the role of complex signal processing in the differential diagnosis of auditory dysfunction.
 325. **Hearing Aids.** II. 3 hr. PR: SPA 322. Principles of the electronic design of amplification systems and acoustic analysis of amplification systems. Hearing aid evaluation procedures.
 328. **Clinical Administration Audiology.** I. 3 hr. PR: Consent. The examination of the procedures for initiating and maintaining audiological services in the medical, public school, and community clinical environment.
 329. **Acoustic Instrumentation.** II. 3 hr. PR: SPA 158, 322. Principles of electronic design utilized in clinical auditory testing and amplification. Evaluation and assessment of hearing aids in aural rehabilitation.
 340. **Experimental Phonetics.** II. 3 hr. PR: SPA 153 and consent. Investigation of problems of phonetics as they are related to functional speech. Instruments used in sound analysis and an investigation of various aspects of architectural acoustics.
 341. **Problems in Speech Pathology.** I. 3 hr. PR: Consent. The speech pathologist as a diagnostician and therapist in interdisciplinary investigations. Examination of counseling procedures, administrative practices in varied settings, and organization of programs of various pathologies of speech.
 342. **Advanced Speech Pathology.** II. 3 hr. PR: SPA 251 and consent. Theories of causation and therapies for delayed language development, cleft palate, and cerebral palsy.
 343. **Neuropathologies of Speech and Language.** I. 3 hr. PR: SPA 154, 253, or consent. Speech and language disturbances related to brain injury or maldevelopment. Consideration of the neurological bases, pathologies and psychological factors involved in the loss or lack of development of speech and language.
 382. **Advanced Clinical Practice in Speech.** I, II, S. 1-6 hr. PR: Consent. Emphasis is on the diagnosis of speech disorders and the appropriate therapeutic follow-up. The course presents patient staffing experience in a multi-disciplined environment.
 383. **Clinical Practice in Audiology.** I, II. 1-6 hr. PR: SPA 220 or equiv. and SPA 383 may be taken in conjunction with SPA 322. Supervised experience in the administration and interpretation of audiological evaluative procedures, and application of therapeutic techniques in aural rehabilitation.
 387. **Special Topics.** I, II. 1-6 hr. PR: Consent. Open to graduate students in speech pathology and audiology who are pursuing independent problems in that field. May be repeated.

480. **Seminar.** I, II, S. 1-6 hr. PR: Consent. Topics vary from term to term to meet student needs. Suggested topics: organic speech impairment, speech pathology research, aural rehabilitation research, medical audiology research, etc.
497. **Research.** I, II. 1-15 hr.

DIVISION OF EDUCATION

The Division of Education is comprised of resident courses of instruction and facilities for research; University High School with its opportunities for observing, student teaching, directed supervision, and experimentation; and cooperating elementary and secondary schools for supervised student-teaching experience.

Programs are accredited by the National Council for Accreditation of Teacher Education for the preparation of elementary teachers, secondary teachers, school service personnel, and school administrators, with the doctor's degree as the highest degree approved.

Master of Arts

Requirements for Admission to Graduate Work in Education

It is the responsibility of all applicants for admission and all candidates for graduate degrees and certificates to conform to the general regulations of the Graduate School.

Requirements for Admission to Candidacy for the Master's Degree in Education

Graduate students apply to the Office of Admissions and Records for admission. Scores on the Aptitude Test of the Graduate Record Examination should accompany the application but must, in all cases, be submitted to the respective Department prior to completion of the first 15 semester hours of graduate study. Students may take no more than 9 semester hours in extension prior to completion of at least 6 semester hours in residence. Conditions of admission to the master's degree program in education follow.

For admission to candidacy for the Master's Degree in Education, students must have a professional teaching certificate based upon an approved teacher education program or at least 20 semester hours of approved undergraduate credit in education.

Students may be admitted as degree candidates on submission of a minimum composite score of 950 on the Aptitude Test of the Graduate Record Examination, or an undergraduate grade-point average of 2.5 (based on a 4.0-point system). These students may pursue the program of their choice immediately.

Students who do not meet either of the above admission requirements may take a maximum of 9 semester hours of course

work. At the end of this period students may apply to the respective Department for review of their admissions classification. Re-classification will be considered *only* in cases in which the student has achieved a *minimum* grade-point average of 2.75 for the first 9 semester hours of graduate study. All work taken up to the conclusion of the term in which the ninth semester hour is earned will be used in computing the grade-point average. If the student is not reclassified to degree program status by the respective department, he is not eligible to continue graduate study in the Division of Education. He may, upon petition to the Department Chairman, be permitted to take additional course work for the renewal of his teaching certificate.

Optional Routes Towards a Master's Degree in Education

A. Thirty semester hours, including 6 semester hours of research. Examination (oral, written, or both, at the discretion of the candidate's advisory committee);

B. Thirty semester hours, including 3 semester hours of research, selected in conference with the candidate's committee, directed by the adviser, with final approval by the committee and 27 semester hours of course work. Examination (oral, written, or both, at the discretion of the candidate's advisory committee.);

C. Thirty-six semester hours. Examination (oral, written, or both, at the discretion of the candidate's advisory committee); and

D. Program options D and E are offered in several programs.

Special Requirements for the Master's Degree in Education

1. No student may be awarded a master's degree in Education unless the student has a minimum grade-point average of 2.75 on all work taken for graduate credit. (A grade of less than "C" does not carry credit toward a graduate degree, but will be counted in determining the grade-point average.)

2. No student will be permitted to repeat a required graduate course more than once.

3. Fifteen semester hours of approved courses in extension may apply toward the completion of degree requirements, if no work is transferred from another institution. A maximum of 12 hours of approved extension courses may be used for certification.

4. The maximum number of hours which may be used from extension courses and transfer credit combined is 15.

5. Students are limited to earning 9 hours in any one field in extension.

6. Students must submit an application to take the final Master's degree examination within the first week of the summer term or two weeks of the semester in which they intend to take

it. All applications should be submitted to the Office of Student Advising and Records.

NOTE: All persons working toward administrative certificates in Education or who wish to add additional administrative certification shall be required to pass a screening examination of the Education Administration Department.

NOTE: A candidate who fails the final master's degree examination may, upon written consent of his advisory committee, be given a second examination not earlier than the following term or semester. A candidate who fails the second examination may, upon written request and with the unanimous consent of his committee, be given a third and final trial no earlier than one calendar year from the date of his second examination.

GRADUATE PROFESSIONAL EDUCATION CURRICULA

Graduate Professional Education Curricula are offered in three major areas within the Division:

- I. *Administration*
Elementary School Principals
Secondary School Principals
Superintendents
- II. *Curriculum and Instruction*
Elementary-School Classroom Teachers
Industrial Arts (Technology)
Secondary-School Classroom Teachers
Supervisors of Instruction
Teacher Librarians
- III. *Health Education*

The administrative certificates issued by the State Department of Education for superintendents, principals (elementary and secondary) and supervisors are called Professional Administrative Certificates.

Curriculum for School Superintendents¹

Degree: Certificate of Advanced Study

Required Courses

Ed. Adm. 315.....	3
Ed. Adm. 318.....	3
Ed. Adm. 341.....	3
Ed. Adm. 342.....	3
Ed. Adm. 470.....	3
Ed. Adm. 480.....	3
Ed. Adm. 497.....	3
Stat 311	3
Electives*	12

36

¹Prerequisites: (1) Master's degree from an institution of education accredited to grant the degree; (2) provisional administration certification.

*May be taken inside or outside the College of Human Resources and Education with adviser's consent. CHR&E courses not applicable as electives: EdA 300, 320 or 331, EdP 391, EdF 320 or CDFR 341 or 348. Students who have not earned credit for equivalent courses must make up certification deficiencies.

Completion Requirements: (1) Successful completion of an approved program with a grade-point average of at least 3.25 for all program work attempted. (2) Successful completion of an approved research project.

Curriculum for Elementary and Secondary Principals

Degree: Master of Arts

I. Required Courses

	Thesis Option	Hours Option
Ed. Adm. 300.....	3	3
Ed. Adm. 312.....	3	3
Ed. Adm. 320.....	3	3
Ed. Adm. 330.....	3	3
Ed. Adm. 331.....	3	3
Ed. Adm. 385 (Theory)	3	3
Ed. Adm. 497.....	6	0
Ed. Found. 320	3	3
Ed. Psych. 320/330	3	3
Ed. Psych. 391 or CDFR 341/348	3	3
C&I 301/304	3	3
Electives*	0	6
	36	36

II. Internship Program (Optional)

Ed. Adm. 350.....	6	6
	42	42

*Outside the College of Human Resources and Education and with adviser's consent.

Completion Requirements: (1) Successful completion of an approved program with a grade-point average of at least 3.25 for all work attempted. (2) Thesis option only, successful completion and defense of an approved research project.

Curriculum for Supervisors: General and Special

Degree: Master of Arts

I. Required Courses

Ed. Adm. 300.....	3
Ed. Adm. 320.....	3
Ed. Adm. 331.....	3
Ed. Found. 320	3
Ed. Psych. 320/330.....	3
Ed. Psych. 391 or CDFR 341/348	3
C&I 301/304	3
Electives*	15
	<hr/>
	36

II. Internship Program (Required for Certification)

Ed. Adm. 350.....	6
	<hr/>
	42

*Adviser's consent required.
General Supervisors: Methods in curriculum subjects.
Special Supervisors: 12 hours must be graduate courses in fields of specialization.

Completion Requirements: Successful completion of an approved program with a grade-point average of at least 3.25 for all work attempted.

Curriculum for Elementary School Classroom Teachers*

Degree: Master of Arts

I. Required Courses

	Program	A ¹	B ¹	C ¹	D ¹	E ¹
Ed. Psych. 330.....	3	3	3	3	3	3
Ed. Psych. 320.....	3	3	0	3	3	3
C & I 350	3	3	3	0	3	3
C & I 340	3	3	3	0	3	3
C & I 330	3	3	3	3	3	3
Rdng. 300	3	3	3	3	3	3
Ed. Found. 320	3	3	3	3	3	3
C & I 301	3	3	3	0	0	0
C & I 391	0	3	0	3	0	0
C & I 497	6	0	0	0	0	0
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total.....	30	27	21	18	21	21

II. Approved Electives	0	3	0-15**	0	0
III. Specialization	0	0	0-15	12	18
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total for Master's Degree	30	30	36	30	36

Curriculum for Secondary School Classroom Teachers†*

Degree: Master of Arts

I. Graduate Courses in Education..... 12-18 Hr.

Required Courses..... 6 Hr.

	Program	A ¹	E ¹	C ¹
C & I 304		3	3	3
Ed. Found. 320 or C & G 303.....		3	3	3
Ed. Psych. 330		3	3	0
Ed. Psych. 320		3	3	0
C & I 391		0	3	0
C & I 497		6	0	0
		<hr/>	<hr/>	<hr/>
Total.....		18	15	6

II. Approved Electives*..... 6 Hr. (Min.)

III. Graduate Courses in one of the candidate's certified fields** 12-18 Hr.

IV. Graduate Courses in another of the candidate's teaching fields*** 6 Hr. (Min.)

Alternate Program for II, III, IV

I. Graduate Courses in one of the candidate's certified teaching fields 18-24 Hr.

II. Free electives 0- 6 Hr.

Total for Master's Degree 30-36 Hr.

† NOTE: In some programs listed on pp. 246-248 a combination of undergraduate courses and courses listed in graduate program is necessary to meet certification requirements.

*Students who wish to pursue a program in home economics education must enroll in the Division of Family Resources.

**Candidates with library science as a major teaching field must follow the curriculum for Teacher-Librarians.

***This provision does not apply to candidate pursuing Programs A or B.

A¹—Thesis required

B¹—Research problem required

C¹—36 semester hour program for classroom teacher

D¹—Concentration in Elem. Sch. Mathematics—Math. 231, 232, C & I 333, 395, or 438 (3 hr.)

E¹—Concentration in Early Childhood Ed.—C&I 210, 211, CDFR 244 or 348, 341 or 345 or Speech 275, C&I 395 (3 hr.)

**At least 9 hr. must be in courses not offered by Education or Clinical Studies

Curriculum for Industrial Arts (Technology) Students*

Degree: Master of Arts—(Also minimum entry level for Ed.D. programs under Curriculum & Instruction)

I. Suggested Courses **	Option A¹	B¹	C¹
Ed. Psych. 320.....	3	3	3
Ed. Psych. 330.....	3	3	3
I.A. 300	3	0	0
I.A. 301	3	0	0
I.A. 310	0	3	0
I.A. 311	0	3	0
I.A. 320	0	0	3
I.A. 321	0	0	3
I.A. 385	3	3	3
I.A. 400	3	3	3
I.A. 404	3	3	3
	—	—	—
Total.....	21	21	21
II. Electives.....	15	15	15
I.A. Electives 401, 402, 405	—	—	—
Total.....	36	36	36

Students are encouraged to select their electives from the total University offerings which contribute to a broad understanding of the physical technologies. Prior approval by the adviser is required.

*Teachers wishing to pursue a graduate degree program in industrial arts (technology) must enroll in this program.

**All graduate programs are designed by the student and his adviser to meet his specific needs.

A¹— Technical Specialty in Transportation.

B¹— Technical Specialty in Communication.

C¹— Technical Specialty in Production.

Curriculum for Health Education

Degree: Master of Arts

I. Required Courses (6 Semester Hours)

C & I 304—Secondary School Curriculum..... 3

Ed. Found. 320—Philosophy of Education

OR

C & G 303—Basic Course in Guidance..... 3

II. Elective Courses (with consent of adviser - 12 Semester Hours)

Ed. Psych. 330—Advanced Education Measurement	3
Ed. Psych. 260—Audio-Visual Resources for Instruction.....	3
Ed. Psych. 440—Human Development and Behavior	3
Ed. Psych. 450—Psychological Foundations of Learning	3
Ed. Psych. 451—Principles of Instruction.....	3
CDFR 246—Adolescent Development	3
Ed. Found. 300—Sociology of Education.....	3
Ed. Found. 340—Historical and Sociological Foundation of American Education.....	3
Ed. Psych. 361—Communication and Education Media	3

III. Required Health Education Courses (18 Semester Hours)

H. Ed. 301—Advanced School Health	3
H. Ed. 305—Philosophy of Health Education.....	3
H. Ed. 306—Community Health.....	3
H. Ed. 376—Evaluation of Health Information.....	3
H. Ed. 497—Individual Research Problems in Health Education	3

Curriculum for Teacher-Librarians*

Degree: Master of Arts in Education

I. Graduate Courses in Education.....	12 Hr.
A. Required Courses in Education	9 Hr.
Ed. Psych. 260	
Ed. Psych. 320	
C & I 391	
B. Approved Electives.....	3 Hr.

*See dagger NOTE on page 246.

Curriculum and Instruction

C & I

205. **The Junior High School.** I, II. 2 hr. PR: Consent. Developing philosophy, program, and practices of the junior high school.
210. **Early Childhood Education.** SII. 3 hr. PR: CDFR 141, 142, C & I 100. An examination of the role that early childhood education plays in the development of the child. Attention is given to the scope, content, and nature of programs for young children as well as developing the knowledge, skills, and attitudes necessary for working in such programs. Students will be given opportunities to observe and participate in early childhood programs and to engage in research at this level.
211. **Early Childhood Education.** SII. 3 hr. PR: CDFR 141, 142, C & I 210. Continuation of C & I 210.
237. **Mathematics in the Junior High School.** II. 3 hr. PR: 6 hr. college math, or consent. Study of teaching of mathematics in the junior high school and/or middle school; application of mathematics content to teaching; instructional techniques and materials
267. **The Music Education Program.** S. 3 hr. PR: Consent. Organization and administration of the complete Music Education program for grades 1-12.

278. **Vocational Home Economics in Secondary Schools.** I. 3 hr. PR: Ed. Psych. 106, 25 hr. in Home Economics (Family Resources).
280. **Special Problems and Workshops.** I, II, S. 2-4 hr. PR: 14 hr. in Education. To take care of credits for special workshops and short intensive unit courses on methods, supervision, and other special topics. Maximum of 8 semester hours may be applied toward the Master's Degree, of which no more than 6 semester hours will be in Extension.
287. **Student Teaching Clinical Experience in Elementary or Secondary Education.** I, II, S. 2-4 hr. PR: Consent. Advanced course in student teaching, stressing clinical procedures in classroom learning problems.
288. **Clinical Practices in Public-School Speech and Hearing Therapy.** I, II, S. 2-8 hr. PR: Consent. Includes experience in Grades 1 to 12. This course meets the requirements of SPA 282 and 283.
301. **The Elementary-School Curriculum.** I, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of curriculum designs in elementary education with emphasis on methods and techniques of development.
304. **The Secondary-School Curriculum.** I, II, S. 3 hr. PR: High-school teaching experience, or consent. Emphasizes socio-economic and cultural influences on the curriculum; principles of curriculum development; curriculum building in the various teaching fields; techniques of experimentation and evaluation; and practice in curriculum building with special emphasis on unit construction.
307. **Curriculum Principles and Patterns in General Education.** II. 2 hr. PR: 6 hr. of curriculum development in education. Major emphasis on principles, philosophy, and concepts of curriculum development in schools; means and ends in general education.
309. **Problems in Elementary and Secondary-School Curriculum.** I, II. 2 hr. PR: 8 hr. of graduate education, including C & I 304. Critical study of selected problems in curriculum with special emphasis on research.
330. **Mathematics in the Elementary School.** II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education or consent. Materials and methods of instruction for modern mathematics programs.
333. **Corrective Techniques in Mathematics Education.** I, S. 3 hr. PR: Consent. Materials and methods used in diagnosis and remediation of learning difficulties in mathematics.
334. **Mathematics in the Secondary School.** I, S. 3 hr. PR: Consent. Patterns of mathematics curriculum in the secondary school; practices in teaching mathematics; preparation, selection and use of instructional materials.
340. **Science in the Elementary School.** I, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. An analysis of methods, curriculum patterns, and trends in elementary school science. Attention is given to the understanding and development of scientific attitudes appropriate at the elementary school level.
350. **Social Studies in the Elementary School.** I, II, S. 3 hr. PR: 20 hr. of undergraduate credit in elementary education, or consent. Comprehensive consideration of objectives, content, methods, including unit procedures; materials including objects, models, exhibits, and museum items as well as textbooks, collateral reading, maps, and graphs; and means of evaluating social growth and development.

354. **Social Studies in Secondary Schools.** I, S. 3 hr. PR: Consent. Nature and function of social studies in the secondary school; utilization of community, state, national, and world resources in teaching; selection of content for teaching purposes; curriculum construction with emphasis on resource and teaching units.
357. **Principles of Economic Education.** S. 3 hr. A workshop for principals, teachers, and supervisors with emphasis on the economic structure of our society and methods of integrating economics into the school program. Sponsored jointly by the College of Human Resources and Education and the College of Commerce.
363. **Teaching Young and Adult Farmer Classes.** I, S. 2 hr. PR: Ed. Psych. 106. Participation in conducting young and adult farmer classes and school-community food preservation centers; organization, course of study, and methods of teaching and supervision, and young farmers' association.
364. **Organizing and Directing Supervised Farming Programs.** II, S. 2 hr. PR: Consent. Planning programs of supervised farming, supervising and evaluating such programs for all-day students, young farmers, and adult farmers.
380. **Special Topics.** I, II, S. 1-6 hr. PR: Consent.
383. **Seminar.** I, II, S. 1-6 hr. PR: Consent.
391. **Problem in Education.** I, II, S. 3 hr. Research for Master's degree in Education, option B.
395. **Practicum.** I, II, S. 1-12 hr. per sem. or term—aggregating not more than 12 hr. PR: 9 graduate hr. in Education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Education.
438. **Survey of Major Issues in Mathematics Education.** II, S. 3 hr. PR: Consent. Individual and group research on selected topics in mathematics education.
460. **Planning Programs and Courses for Vocational Agriculture Department.** I, S. 2 hr. PR: C & I 188. Gathering data, studying the farming problems of all-day students, young farmers, and adult farmers, and planning the total program for the department. (Also listed as Agricultural Education 460).
491. **Project in Education.** I, II, S. 3-6 hr. Research for the program leading to the Certificate of Advanced Study in Education.
497. **Research.** I, II, S. 1-15 hr.

Education Administration

Ed. Adm.

300. **Public School Organization and Administration.** I, II, S. 3 hr. Basic concepts through which administrators, supervisors, and teachers gain understanding of general problems related to the operation of schools and school systems.
312. **Principalship.** I, II, S. 3 hr. PR: Consent. The study of school building administration emphasizing planning, policy formulation, decision making and managerial practices.

315. **Superintendency.** I. 3 hr. PR: Consent. The examination of the roles, relationships, behaviors and competencies which characterize the school superintendent and his staff.
318. **School Business Administration.** II. 3 hr. PR: Consent. Policies and practices of sound business administration for central office school administration.
320. **Staff-Personnel Administration.** I, II, S. 3 hr. PR: Consent and EdA 300. Selection, induction, direction, evaluation, improvement and promotion of members of the administrative, supervisory, instructional, research, clerical and maintenance staffs.
321. **Pupil-Personnel Administration.** S. 3 hr. PR: Consent. Pupil accounting, guidance, extracurricular activities and control.
330. **Principles of Educational Leadership.** I, II, S. 3 hr. PR: Consent. An integrated study of the problems of school leaders in the areas of administration, supervision and instruction.
331. **Principles of Supervision.** I, II, S. 3 hr. PR: Consent. General principles of elementary, junior high and senior high school supervision.
340. **Economics of Public Education.** S. 3 hr. PR: Consent. Basic concepts in the economics of public education.
341. **School Buildings and Equipment.** S. 3 hr. PR: Consent. Philosophy, planning, and management of the school plant as an appropriate educational environment.
342. **Public Education and the Law.** II, S. 3 hr. PR: Consent. Legal permissives and limitations involved in setting policy for organization of, and administration of public schools.
350. **Internship A.** I, II, S. 2 hr. PR: Consent. Public school internship in administration and supervision. May be repeated for a maximum of 8 hours credit.
385. **Practicum.** I, II, S. 1-12 hr. PR: Consent.
470. **Interdisciplinary Approaches for School Administrators.** 3 hr. PR: Consent. II. The study of education administration using simulation and pertinent academic materials.
480. **Seminar.** I, II, S. 1-6 hr. PR: Consent.
485. **Special Topics.** I, II, S. 1-6 hr. PR: Consent.
497. **Research.** I, II, S. 1-15 hr. PR: Consent.

Education Foundations

Ed. Found.

300. **Sociology of Education.** I, II. 3 hr. An examination of education as a social institution; cultural and class influences on education; social roles and career patterns in the school system; the school and problems of the community.
320. **Philosophy of Education.** I, II, S. 3 hr. A study of educational aims, values, and criteria of education in a democracy. Stresses different systems of educational philosophies, the nature of thinking applied to methods and subject matter.
340. **Historical and Sociological Foundations of American Education.** I, II, S. 3 hr. A study of the development of American education. Emphasis placed upon movements and leaders.

- 380. **Special Problems and Workshops.** I, II, S. 1-6 hr. PR: Consent.
- 383. **Seminar.** I, II, S. 1-6 hr. PR: Consent.
- 385. **Practicum.** I, II, S. 1-12 hr. PR: Consent.
- 390. **Special Topics.** I, II, S. 1-6 hr. PR: Consent.
- 497. **Research.** I, II, S. 1-15 hr.

Educational Psychology

Ed. Psych.

- 231. **Sampling Methods.** I. 3 hr. PR: An introductory course in statistics. Methods of sampling from finite and infinite populations, choice of sampling unit, sample survey design, estimation of confidence limits and optimum sample size, and single- and multi-stage sampling procedures. (Equiv. to Stat. 231).
- 260. **Audio-Visual Resources for Instruction.** I, II, S. 3 hr. A survey of many types of materials available for teaching. Multi-sensory techniques, sources of materials, and practical classroom utilization are considered. Laboratory period per week is arranged.
- 311. **Statistical Methods 1.** I, II, S. 3 hr. PR: Math. 3. Basic concepts of statistical models, distributions, probability, random variables, tests of hypotheses, confidence, intervals, regressions, correlation, transformation, F and X^2 distributions, analysis of variance of one- and two-way classification models, multiple range tests, missing plots, and sample size. (Equiv. to Psych. 311 and Stat. 311).
- 312. **Statistical Methods 2.** I, II, S. 3 hr. PR: Stat. 311. Extension of basic concepts of statistical models, design of experiments, multi-way classification models, factorials, split plot design, simple covariance, orthogonal comparisons, multiple linear and nonlinear regression and correlation analysis, chi-square, and non-parametric statistics. (Equiv. to Stat. 312).
- 320. **Introduction to Research.** I, II, S. 3 hr. PR: Ed. Psych. 211. Introduction to methods and techniques of research in education. Major emphasis on design, analysis, interpretations, and reporting of research.
- 321. **Design of Experiments.** I. 3 hr. PR: Ed. Psych. 312 or equiv. Extension of basic concepts of statistics to the more complicated models and use of samples, design and analysis of experiments over time and space, fractional replications, incomplete block design, cross-over designs, lattice designs, and least squares analysis for designs with unequal subclass numbers. (Equiv. to Stat. 321).
- 330. **Advanced Educational Measurement.** I, II. 3 hr. Background for educational measurement, the nature of evaluation, measuring and predicting pupil progress. Basic statistics including measures of central tendency, percentiles, variability, and simple correlation.
- 333. **Nonparametric Statistics.** II. 3 hr. PR: An introductory course in statistics. Single sample tests; for related samples, two independent samples, K related samples, K independent samples, and measures of correlation. (Equiv. to Stat. 333).
- 341. **Multivariate Methods 1.** I. 3 hr. PR: Stat. 311. Introduction to elementary matrix operations, partial and multiple linear and non-linear correlation and regression analyses, and introduction to discriminant analysis. (Equiv. to Stat. 341).

342. **Multivariate Methods 2.** II. 3 hr. PR: Stat. 341 or equiv. This course includes a discussion of the multivariate normal distribution, tests of hypotheses about the sample mean vectors and variance-covariance matrices from a multivariate normal distribution, and analysis of variance of multiple responses in basic statistical designs. (Equiv. to Stat. 342).
343. **Statistical Analysis in Education.** I, II, S. 3 hr. PR: Ed. Psych. 330 or consent. Review measures of central tendency, percentiles, and correlation. Emphasis placed on correlation, regression, testing hypothesis, non-parametric tests, and other measures in analysis and inference.
360. **Production of Instructional Materials.** I, S. 3 hr. PR: Consent. Techniques planning and developing instructional materials for use in teaching are demonstrated. Individual projects of planning and producing materials are carried out by the student.
361. **Communications and Educational Media.** I. 3 hr. PR: Consent. The psychological implications of communications media in learning and teaching. Attention to educational television, programmed instruction, cross-media, techniques and experimental and developmental programs.
362. **Administration and Management of Media Systems.** II. 3 hr. Media techniques with emphasis on selection and utilization of materials, media centers, inservice programs, budgetary planning, and curricular implementation.
385. **Practicum.** I, II, S. 1-12 hr. PR: Consent.
391. **Problem in Educational Psychology.** I, II, S. 3 hr. PR: Consent.
420. **Advanced Educational Research.** I, II, S. 3 hr. PR: Stat. 311 and consent. Identification of research problems in education, consideration of alternative designs and methods of investigations, and development of a research proposal at the advanced graduate level.
440. **Human Development and Behavior.** I, II, S. 3 hr. A survey of the psychological theories of human development. Contemporary theories are analyzed and compared with emphasis on their implication for classroom behavior and the educational process.
446. **Factor Analysis.** II. 3 hr. PR: Stat. 341. Alternative methods for factor extraction, communalities, rotation in orthogonal and oblique space, and estimation of factor scores. (Equiv. to Stat. 446).
450. **Psychological Foundations of Learning.** I, II, S. 3 hr. A study of the psychological and philosophical foundations of major learning theories and their implications for instructional procedures.
451. **Principles of Instruction.** I, II, S. 3 hr. PR: Consent. Emphasizes the basic principles of teaching-learning process implied in major learning theories; study of factors in learning, variables in the instructional program, and principles of instructional design.
480. **Seminar.** I, II, S. 1-6 hr. PR: Consent.
481. **Special Topics.** I, II, S. 1-6 hr. PR: Consent.
497. **Research.** I, II, S. 1-15 hr.

Health Education

Health Educ.

- 301. **Advanced School Health.** I, S. 3 hr. PR: Health Educ. 101, 20 hr. of Education, graduate standing and consent. An analysis of problems in school health services, healthful school living, the nature of health education, and the scope of health instruction which confronts teachers and administrators.
- 305. **Philosophy of Health Education.** I, S. 3 hr. PR: Health Educ. 2, and 101, graduate standing and consent. Analysis of the scientific bases, purposes, procedures, and content, with implications for school and public health education.
- 306. **Community Health.** II, S. 3 hr. PR: Health Educ. 2, and 305 or equiv. Health problems requiring community action, basic public health activities, community organization for health protection, voluntary health agencies, school health programs and the role of state and federal agencies in the community health program.
- 376. **Evaluation of Health Information.** I, S. 3 hr. PR: Health Educ. 2, and 301, or 20 hr. of Education and consent. Study of published material to determine basic scientific accuracy and value.
- 494. **Seminar.** I, II, S. 1-6 hr. PR: Health Educ. 305. An overview and critical analysis of the literature and research in health education.
- 497. **Research.** I, II, S. 1-15 hr.
- 498. **Practicum.** I, II, S. 1-12 hr. PR: Health Educ. 494. Program planning, curriculum development and job functions in health education.

Industrial Arts (Technology)

I.A.

(The courses which follow have been designed to meet the diverse and special needs of all teachers in the technologies).

- 280. **Special Problems and Workshops.** I, II, S. 1-6 hr. PR: 14 hr. in Education. To take care of credits for special workshops and short intensive unit courses on methods, supervision, and other special topics. Maximum of 8 sem. hr. may be applied toward the master's degree, of which no more than 6 sem. hr. shall be in extension.
- 300. **Contemporary Problems in Transportation.*** 3 hr. A study of the technical and social cultural problems related to man's efforts in developing and utilizing new and improved modes of transportation.
- 301. **Technical Developments in Transportation.*** 3 hr. PR: I.A. 300 or consent. A study of selected developments in transportation technology. Identification of principles, concepts and processes fundamental to the design and development of educational programs in the technologies.
- 310. **Contemporary Problems in Communication.*** 3 hr. A study of the technical and social cultural problems related to man's efforts to develop, improve and utilize new and improved modes of communication.

All courses marked with an asterisk () are offered on a planned sequence, i.e. fall, summer, spring, summer.

311. **Technical Developments in Communication.*** 3 hr. PR: I.A. 310 or consent. A study of selected developments in communications technology; the identification of principles, concepts and processes fundamental to the design and development of educational programs in the technologies.
320. **Contemporary Problems in Production.*** 3 hr. A study of the technical and social/cultural problems resulting from man's efforts to develop, improve and utilize new and improved methods of producing goods and services.
321. **Technical Developments in Production.*** 3 hr. PR: I.A. 320 or consent. A study of selected developments in production technology; the identification of principles, concepts, and processes fundamental to the design and development of educational programs in the technologies.
330. **Contemporary Problems in Research and Development.** S. 3 hr. A study of fundamental, direct and applied research and scientific investigations in transportation, communication, and production technology; technical and social/cultural problems related to man's efforts in research and development.
350. **Industrial Arts Therapy.** I, II, S. 8 hr. Individualized instruction in the teaching techniques of industrial arts and therapeutic practices in rehabilitation of the handicapped.
383. **Seminar.** I, II, S. 1-6 hr. PR: Consent.
385. **Practicum.** I, II, S. 1-12 hr. PR: 8 graduate hr. in Education. Enrollment with permission of adviser or instructor in consultation. Special individual and group projects. To provide appropriate residence credits for special workshops, prolonged systematic conferences on problems and projects in Education.
390. **Special Topics.** I, II, S. 1-6 hr. PR: Consent.
400. **Technology: Its History and Development.*** 3 hr. A study of the major technical periods in man's history and the interrelationships of technological developments to the social/cultural milieu.
401. **Curriculum Development and Physical Facility Design in Technology.** I, II, S. 3 hr. PR: Consent. Development of curriculum components for education in the technologies and a study of the physical facility design requirements related to curricular implementation.
402. **Development of Instructional Materials in Technology.** I, II, S. 3 hr. PR: Consent. A study of newer instructional media; development of media and instructional units for education in the technologies.
403. **Design in Technology.** S. 3 hr. Emphasis on the application of design components in technology education.
404. **Readings in Technology and Culture.*** 3 hr. A study of the fundamental, historical and contemporary ideas of the nature of technology as an area of man's created knowledge.
405. **Innovation and Invention.*** 3 hr. A study of the historic and current importance of man's innovative thought in his developing technology.
490. **Projects in Industrial Arts.** I, II, S. 1-6 hr. PR: Consent.
491. **Problems in Industrial Arts.** I, II, S. 1-6 hr. PR: Consent.
497. **Research.** I, II, S. 1-15 hr.

DIVISION OF FAMILY RESOURCES

The Division of Family Resources offers work leading to the degree of Master of Science.

All candidates for the graduate degree must conform to the general regulations of the Graduate School and the Division of Family Resources.

After applying to the Graduate School, applications will be reviewed by the Graduate Admissions Committee of the Division. At that time, an applicant will be notified by the Chairman of the Graduate Admissions Committee of the Division that he is accepted to pursue graduate study toward candidacy for Master of Science degree, or is accepted as a "special" student (reapplication is required at a later date), or is not accepted for graduate study in the Division. And in addition all students pursuing graduate work are required to take the Graduate Record Examination. A student must have a 2.5 overall undergraduate average and must maintain a 3.0 grade-point average in course work taken within the Division in order to be awarded the master's degree from the Division of Family Resources. Additional detailed information may be obtained by writing the Director of the Division.

The graduate program of the Division is designed to offer qualified students opportunity to work in a variety of different specializations as well as the opportunity to take graduate level course work in supporting disciplines.

The specializations generally will coincide with the subject matter areas offered in the Division. However, the specific course work requirements for the degree of Master of Science will in all cases rest with the graduate guidance committee of the student, and be approved by the Director of the Division.

To enter the graduate program of the Division, an applicant must have a bachelor's degree from an accredited institution and sufficient background in the area of specialization to qualify for admission to graduate courses in that area.

As of January 1, 1967, *no* student will receive graduate credit for course work taken prior to or concurrent with the semester in which his graduate application is received by the Division. In very exceptional cases, and not to include any circumstances surrounding lateness of application, course work taken prior to application to the Graduate School may be approved with the written consent of the entire graduate guidance committee of the student. Attached to such an application for approval of prior course work will be a statement by the student explaining the circumstances of the situation. Such application will be submitted first to the Chairman of the Graduate Admissions Committee of the Division for approval before being sent for approval to the student's guidance committee.

A student will select either (A) the thesis or (B) the course work program:

(A). A student pursuing the thesis program will take a minimum of 24 semester hours of course work, and in addition 6 semester hours of credit for the thesis. After the student in the thesis program has completed 12 hours of on-campus course work, his graduate guidance committee will review his course work for academic performance with reference to admission to candidacy for Master of Science degree. The graduate guidance committee of each student will be considered by the student and the major professor in selecting a thesis topic and in completing the thesis requirement. The approval of the thesis following an oral examination by the graduate guidance committee of the student will be required before the degree is granted. The graduate guidance committee shall consist of a minimum of three members, at least two of whom must be members of the Graduate Faculty of the University and two of whom must be members of the Faculty of the Division of Family Resources.

(B). The student completing the course work option will take a minimum of 36 semester hours of credit, approved by his graduate guidance committee. After the student in the course work option program has completed 12 hours of on-campus work, his guidance committee will review his course work for academic performance with reference to admission to candidacy for Master of Science degree. The graduate guidance committee shall consist of a minimum of three members, at least two of whom must be members of the Faculty of the Division of Family Resources. Near the end of his graduate study, he shall be required to take a written comprehensive examination which shall be prepared, evaluated and approved by the above committee.

Approval in writing must be secured in advance from the student's graduate guidance committee to elect graduate courses offered at other institutions or by University Extension.

Home Economics Education

H.E. Ed.

311. **Home Economics Curriculum.** 3 hr. PR: Experience in teaching home economics or consent. Theory and research in curriculum applied to home economics. Emphasis on change within existing programs and development of new programs.
312. **Supervision in Home Economics.** 3 hr. PR: Teaching experience and consent. Designed for home economics teachers preparing to serve as supervising teachers in off-campus training centers. Function of supervision and organization of supervised teaching program. Techniques for helping students in training for teaching home economics.
313. **Evaluation in Home Economics.** I. 3 hr. PR: 30 hr. of Home Economics, 7 hr. of Education or consent. Experience in devising, selecting, and using a variety of techniques for evaluating progress toward cognitive,

affective, and psychomotor objectives in home economics. Offered alternate odd years.

314. **Adult Education.** 3 hr. PR: Consent. Psychology of adult learning, philosophy, types of programs to include, organization, methods and techniques, and leadership training in working with adult groups.

Textiles and Clothing

TC

224. **Advanced Clothing Construction. I.** 3 hr. PR: TC 123 or consent. Offers opportunity for creative expression and for understanding of pattern design through flat pattern and draping methods. Costumes are designed and constructed by use of both of these techniques.
227. **Advanced Textiles. I, II.** 3 hr. PR: TC 27. Comparative characteristics of all textile fibers are presented. Physical and chemical properties are explained with reference to fiber morphology and/or manufacturing processes. Textile fiber products legislation is reviewed. Physical and chemical laboratory testing experience is provided.

Housing and Design

HD

233. **Interior Design II.** 3 hr. PR: 9 hr. HD courses. Technical and design information necessary to comprehend and function within the contemporary home furnishings market.

Child Development; Family Relations

CDFR

244. **Family and Individual in the Community. I, S.** 3 hr. PR: One course in the family, or sociology, or consent. Social psychological analysis of the individual in the family and in other social systems. Involves the study of role relationships, community processes and attitudes and values as they affect the behavior of the individual.
245. **Family Development. II, S.** 3 hr. PR: CDFR 144 or consent. A course designed to increase knowledge and understanding of comparative family patterns through the use of cross-cultural and historical materials. Intensive study of family development in contemporary United States with special attention to social class differences and the use of the life cycle and developmental task concepts as analytic tools.
246. **Adolescent Development. II.** 3 hr. PR: CDFR 141 and 142. An investigation of the adolescent in contemporary American culture, including normative physical, social, and personality development; and relationships within various typical social settings (e.g., family, school, community, peer group).
341. **Cognitive Development of the Child. I.** 3 hr. PR: CDFR 141 and 142 or consent. A normative survey of logical thought development from infancy to adolescence. Emphasis is directed toward the growth of quantity-numerical, spatial-geometric, and logical operations concepts and their relationship to basic sensory-perceptual functioning during the 2-year to 12-year-old interval.
345. **Socio-Emotional Development of the Child. II.** 3 hr. PR: CDFR 141 and 142. A study and examination of contemporary theory and research into various facets of the socialization process and the development of attitudes in the child.

347. **Comparative Study of the Family.** 3 hr. PR: CDFR 144 or consent. The comparative method as a framework for family analysis. The family as both an independent and dependent variable in social change in relation to other social systems. Modal and unique patterns of structure and functioning. Alternative methods for achieving similar cultural objectives. Converging patterns in the contemporary world setting.
348. **Theories of Child Development.** S. 3 hr. PR: CDFR 141, 142 or consent. An examination of the major theoretical conceptions of child development. The work of Werner, Piaget, Lewin, Freud, and the American learning theorists will be covered.

Foods; Institution Administration

FIA

255. **Experimental Foods, II.** 3 hr. PR: FIA 55, Chem. 131, or consent. (1 hr. lec., two 2-hr. labs.) The study and experimentation with factors involved in food processing under various conditions. Offered alternate odd years.
258. **Laboratory Practice in Institution Management.** I, II. 3 hr. PR: FIA 158 and consent. Experience under supervision in planning, preparing and serving food in an institution. Selection of place and type of experience to be determined by needs of students.

Home Management; Family Economics

HMFE

261. **Consumer Economics.** II. 3 hr. PR: Econ. 51 or HMFE 161, or consent. Course designed to help students understand the role of consumer in our economy. Involves the study of research methods and techniques being used to identify, understand, and solve consumer problems.

Nutrition

NTR

271. **Human Nutrition.** I. 3 hr. PR: NTR 71, biochemistry, physiology. The role of food nutrients in the physiological and biochemical processes of the body; nutritional needs of healthy individuals under ordinary conditions and in periods of physiologic stress. Offered alternate even years.
273. **Family and Community Nutrition.** II. 3 hr. PR: Consent. Special emphasis is given to nutritional status of the individual and family in the community. Students study nutritional problems and work toward their solutions through fieldwork.
274. **Diet Therapy.** II. 3 hr. PR: NTR 271, Biol. 266. Adaptations of normal diet for diseases whose prevention or treatment is largely influenced by diet. Offered in alternate odd years.

Family Resources—Seminars

282. **Seminar in Clothing or Textiles.** I, II. S. 1-4 hr. per sem., max., 9 hr. Critical examination of significant contemporary issues in the area of clothing or textiles.
283. **Seminar in Housing or Design.** I, II. S. 1-4 hr. per sem.; max. 9 hr. PR: 12 hr. HD courses. Critical examination of significant contemporary issues in the area of housing or design.

284. **Seminar in Child Development or Family Relations.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of child development.
285. **Seminar in Foods and/or Institution Administration.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of foods and/or institution administration.
286. **Seminar in Home Management or Family Economics.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of home management or family economics.
287. **Seminar in Nutrition.** I, II, S. 1-4 hr. per sem.; max. 9 hr. Critical examination of significant contemporary issues in the area of nutrition.
381. **Seminar in Home Economics Education.** I, II, S. 1-4 hr.; max. 9 hr. PR: Senior standing and consent. A review and discussion of home economics education at secondary, college, and adult levels. Emphasis on current research and trends in selected areas. Offered alternate odd years.
384. **Seminar in Child Development or Family Relations.** I, II, S. 1-4 hr. per sem.; max., 9 hr. An examination of research procedures used in the study of family relationships and a critical examination of current research in this area.
387. **Graduate Seminar in Nutrition.** I, II, S. 1-4 hr. per sem.; max., 9 hr. Review and discussion of recent progress in foods and/or nutrition research.

Family Resources—Research

390. **Research Methods in Family Resources.** I, II, S. 3 hr. PR: Introductory statistics or consent. A review of research methodology, experimental design, and statistical analysis as relevant to problems in home economics, child development, and family relations. Required for all master's thesis candidates in the Division of Family Resources.
391. **Assigned Topics.** I, II, S. 1-6 hr. per sem.; max. 9 hr.
497. **Research.** I, II, S. 1-15 hr.

Medical Center

The Departments of Anatomy, Biochemistry, Microbiology, Pharmacology, and Physiology and Biophysics each offer programs of study leading to the Master of Science and the Doctor of Philosophy degrees. Admission is permitted only with approval of the department concerned. Students should contact the chairman of the major department and request permission to do graduate work well in advance of the time of registration. Graduate programs in the Medical Center operate under the rules of the Graduate School.

School of Dentistry

The School of Dentistry and its Department of Orthodontics offer a program of advanced study and clinical training leading to the Master of Science degree. The program requires a minimum of 23 months (two academic years and two summer sessions) of full-time residency in the School of Dentistry, and is designed to qualify dentists for careers in orthodontic clinical practice, teaching, and research.

Inquiries concerning this program should be directed to the Department of Orthodontics or the office of the Assistant Dean for Advanced Education Programs. Applicants will be processed in the School of Dentistry and applicants will be recommended to the Graduate School for admission. Those applicants approved for admission to the program will be notified soon after January 15.

Requirements for Admission to Orthodontic Program

1. Graduation from an accredited dental school.
2. Evidence of scholastic and clinical achievement that would indicate the applicant's ability to progress in a program of this nature.
3. Each applicant must file with the department all information requested in the department application form.

Requirements for Master of Science Degree for Students Enrolled in Orthodontic Program of School of Dentistry

1. Fulfillment of requirements of the Graduate School.
2. Twenty-three months (two academic years and two summer sessions) of consecutive residency at the School of Dentistry.
3. An approved master's thesis based on original research completed during the period of residency in an area related to orthodontics.

4. Must satisfactorily pass a final oral examination.
5. Must complete a minimum of 56 credit hours. These include 35 hours of orthodontic courses, a minimum of 9 hours of selected basic science subjects, and a minimum of 6 hours of elective allied subjects, and a thesis (6 hours).
6. Must have demonstrated satisfactory clinical competence in his field.
7. Must have maintained a grade level commensurate with graduate education.

Orthodontics

416. **Biomechanics.** I, II, S. 2 hr. PR: Consent. A study of the design and function of the teeth and their surrounding structures, and the response of these tissues to orthodontic procedures.
417. **Orthodontic Technique.** I, II, S. 2 hr. PR: Consent. A laboratory course in the techniques related to the fabrication and manipulation of orthodontic appliances.
418. **Orthodontic Materials.** I, II, S. 1 hr. PR: Consent. A study of the physical properties of the materials used in orthodontic appliances.
419. **Orthodontic Diagnosis.** I, II, S. 1-3 hr. PR: Consent. A seminar type class on the technique of patient examination, acquiring diagnostic records, and analyzing and correlating this information to the treatment of clinical problems.
420. **Cephalometrics.** I, II, S. 1-3 hr. PR: Consent. The use of radiographic cephalometry in studying growth of the human face, analysis of dento-facial malformations, and evaluation of orthodontic treatment.
421. **Orthodontic Mechanics.** I, II, S. 1-4 hr. PR: Biomechanics 416 and Orthodontic Technique 417. A seminar and laboratory course on basic orthodontic mechanical properties.
422. **Advanced Orthodontic Mechanics.** I, II, S. 1 hr. PR: Orthodontic Mechanics 421. A continuation of Orthodontic Mechanics 421 involving more difficult type cases and introducing more sophisticated appliance therapy.
423. **Growth and Development.** I, II, S. 1-5 hr. PR: Consent. A seminar type course on the normal and abnormal growth of the human head and its application to the field of orthodontics.
425. **Orthodontic Seminar.** I, II, S. 1-8 hr. PR: Consent. Discussions involving all branches of dental science, but with special emphasis on the orthodontic interest. Assigned topics and articles in the literature are discussed.
426. **Orthodontic Clinic.** I, II, S. 1-12 hr. PR: Biomechanics 416 and Orthodontic Technique 417. Clinical treatment of selected patients.
497. **Research.** I, II, S. 1-15 hr.

Division of Medical Technology

The primary purpose of the graduate program in medical technology at WVU is to prepare graduate medical technologists for positions as educators. The program is designed for medical technologists who wish to supervise in a special area of the clinical laboratory, or to administer and teach in a medical technology educational program.

The *primary objective* is to assist in the development of knowledge in a special area of interest selected by the student which may be education, administration, or a special medical laboratory science as the specific area applies to the medical laboratory. All students enrolled in the graduate program in medical technology must fulfill the following requirements.

Requirements for Admission

A. Applicants must have a baccalaureate degree in medical technology from an accredited institution or a baccalaureate degree in an allied field and be a certified medical technologist with the American Society of Clinical Pathologists. The area of concentration in medical technology desired by the student is considered in the evaluation of the undergraduate record as follows.

1. Individuals who desire to do special study in clinical chemistry, hematology, or immunohematology must have completed 8 hours in physics, 3 hours in mathematics, 4 hours in organic chemistry, and 4 hours in quantitative chemistry on the college level.
2. Individuals who desire to do special study in microbiology must have completed 4 hours in organic chemistry and 16 hours in the biological sciences.
3. A minimum of one year's experience in a clinical laboratory is required for admission.

Students will be required to make up deficiencies in the above as well as other deficiencies deemed necessary by the adviser.

B. Applicants must have a minimum undergraduate grade-point average of 2.5 (based on A = 4 grade points) for admission.

C. Two letters of reference must be on file in the Division office. One letter should be from the major adviser in the undergraduate college and another from the immediate supervisor of the applicant's present position. An interview may be requested.

D. Applicants are selected for admission on the basis of scholastic standing, recommendations, and interest in the field of medical technology. The number of applicants accepted is necessarily limited by the available facilities; and in general, applicants with the most experience are considered first.

Application Procedure for Admission

The admission procedure is the same as for other programs in the Graduate School of WVU (see Part 2).

A. The application form for admission should be sent to the Office of Admissions and Records, WVU.

B. Letters of recommendation should be sent to the Division of Medical Technology.

C. The applicant should request all colleges and/or universities where he has done undergraduate or graduate work to send official transcripts to the Office of Admissions and Records, WVU.

D. A personal interview may be required before final admission.

Course of Study

It is expected that the students who enter the program have a goal in mind and a special field of interest in medical technology. The course of study is tailored to the needs of the student. A minimum of 36 semester hours of credit including a research problem is required. These credits are distributed among courses in: (1) research, statistics, education, and health; and (2) an area of concentration in medical technology selected from one of the following clinical sciences:

- | | |
|--------------------------|------------------------|
| 1. Clinical microbiology | 3. Clinical hematology |
| 2. Clinical chemistry | 4. Immunoematology |

A minimum of 12 semester hours of course work in Education to include the following is required:

Educational Psychology 330	Advanced Educational Measurement	3 hours
Educational Psychology 320	Introduction to Research	3 hours
Education Foundations 320	Philosophy of Education OR	
Health Education 305	Philosophy of Health Educ.	3 hours
Educational Psychology 450	Psychological Foundations of Learning OR	
Educational Psychology 451	Principles of Instruction	3 hours

Other courses to complete 36 semester hours are selected by the student (with the help of his adviser) from graduate courses in the area of concentration selected by the student. All students must complete a minimum of 18 semester hours in a science related to medical technology including Medical Technology 300 and Medical Technology 497 (seminar: 3 hours and problem study: 6 hours).

All students are required to pursue study on a problem in their area of concentration. The problem is reported in a style following the form and style for a thesis prescribed in the mimeographed sheets distributed by the Graduate School Office and is presented to the student's departmental adviser at least one month before the end of the semester or summer session in which completion of all requirements is expected.

Examinations

A. A final written comprehensive examination in the major and minor interest areas is given prior to the date on which the degree is to be awarded.

B. An oral defense of the problem is given prior to the date on which the degree is to be awarded.

Requirements for the Degree

A. All requirements for the master of science degree as outlined in this graduate catalog must be fulfilled. These requirements can be fulfilled in three semesters of full-time work, but ordinarily at least four semesters are required for completion of the degree requirements.

B. In addition, degree candidates must have a 3.00 grade-point average and must have removed all incomplete grades and deficiencies.

Financial Assistance

Federal traineeships from the Public Health Service are available to cover tuition, fees, and living expenses. Application for traineeships should be made to the Division of Medical Technology, School of Medicine.

Medical Technology

M.T.

- 300. **Seminar.** I, II, S. 1 hr. Current research and topics in medical technology. A registration requirement for full-time students.
- 497. **Individual Research Problems.** I, II, S. 1-15 hr. Opportunity for independent study and investigation of pertinent problems in medical technology.

School of Pharmacy

The School of Pharmacy offers programs of graduate study leading to the degree of Master of Science in the pharmaceutical sciences. Students may specialize in pharmaceutics, pharmacy administration, pharmacognosy, pharmaceutical chemistry (organic-medicinal or pharmaceutical analytical), or pharmacy.

Admission

Applicants for admission to the program must satisfy the general requirements for admission to the Graduate School of WVU. Beyond this, the applicant should possess a B.S. degree with a minimum overall average of 2.75. In exceptional cases, a student with course deficiencies or with a grade-point average below 2.75 may be admitted as a special graduate student. The record of the student will be reviewed at the end of 12 hours, and he may be allowed to pursue a degree program upon removal of any deficiencies and/or demonstration of ability to perform satisfactorily in the graduate program.

Academic Standards

No credits are acceptable toward a graduate degree which are reported with a grade lower than a "C".

The graduate student must have a cumulative grade-point average of at least 3.0 in all graduate courses to qualify for the degree.

Requirements for Completion of Degree

Upon acceptance to the program, the student will select his major adviser who will also serve as chairman of his advisory committee and of his examination committee, and as his thesis supervisor. The advisory committee will approve a plan of study and a research project for the thesis requirement.

To be eligible for the degree, the student must complete a minimum of 30 hours of graduate credit, of which no more than 6 hours may be for research and thesis.

Upon completion of the course work and research requirements, and after submission of the thesis, an oral examination will be administered by the appointed examination committee.

Further information may be obtained by writing to the Dean, School of Pharmacy, West Virginia University, Morgantown, W. Va. 26506.

Pharmaceutical Chemistry

272. **Organic Pharmaceutical Chemistry.** I, 3 hr. PR: Consent. A study of synthetic drugs and certain natural drug products, with regard to nomenclature, synthesis and therapeutic, physical and chemical properties. 3 hr. lect.

273. **Organic Medicinal Chemistry.** II. 3 hr. PR: Consent. A continuation of Ph.Ch. 272 with special attention given to structure-activity relationship. 3 hr. lect.
274. **Pharmaceutical Analysis.** I. 4 hr. PR: Consent. Application of basic scientific principles to the quality control of drugs and dosage forms, with particular attention to newer analytical techniques. 2 hr. lect., 2 hr. lab.
370. **The Synthesis of Drugs.** 4-5 hr. A course embodying the design of drug molecules on the basis of structure-activity relationships and approaches to the synthesis of such compounds. Laboratory to accompany in which representative types of biologically active compounds are prepared. 3 hr. lect., 1-2 hr. lab.
375. **Advanced Pharmaceutical Analysis.** 3 hr. An overview of methods of spectroscopic methods of analysis with emphasis on their applications in pharmaceutical problems and in the biological sciences. 2 hr. lect., 1 hr. lab.
376. **Advanced Pharmaceutical Analysis.** 3 hr. A continuation of Ph.Ch. 375, with emphasis on electro analytical methods and the preparation of samples from pharmaceutical dosage forms and from biological materials. 2 hr. lect., 1 hr. lab.
377. **Advanced Pharmaceutical Analysis.** 3 hr. A study of the physical-chemical principles involved in methods development. A special problem is assigned as an integral part of the course. 1 hr. lect., 2 hr. lab.

Pharmaceutics

300. **Industrial Pharmaceutics.** 4 hr. An introduction to the manufacture of dosage forms and their quality control. The structure of the industry and governmental influences are included. Special attention is given to new drug evaluation with regard to safety and efficacy. 2 hr. lect., 2 hr. lab.
301. **Advanced Pharmaceutics.** 3 hr. An advanced study of the physiochemical and biopharmaceutical principles involved in homogeneous systems (solutions) which function as dosage forms. Included are considerations of kinetic processes of solution, stability, complexation, solubility, the pharmacokinetics within the body, adjuncts of palatability, etc. 3 hr. lect.
302. **Advanced Pharmaceutics.** 3 hr. An advanced study of the physiochemical and biopharmaceutical principles involved in disperse systems (liquid, semi-solid and solid) which function as dosage forms. Included are considerations of the properties of solid dispersions, micromeritics, diffusion of liquid dispersions, interfacial phenomena, emulsification, suspensions, prolonged action medication, etc. 3 hr. lect.

Pharmacognosy

240. **Pharmacognosy.** II. 6 hr. PR: Consent. A study of drugs of biological origin, both plant and animal; their specific origins, methods of preparation, active constituents, and medicinal and pharmaceutical uses. Example of the methods used in the isolation and study of such products are presented in the laboratory. 5 hr. lect., 1 hr. lab.
340. **Organic Plant Constituents.** 3 hr. A survey of the occurrence, properties, biogenesis, etc. of a number of classes of organic compounds derived from plants. Emphasis will be placed on those classes of secondary

metabolites which contain products of pharmaceutical or medicinal interest. 3 hr. lect.

341. **Isolation of Plant Constituents.** 3-5 hr. A course designed to acquaint the student with techniques used in the extraction, separation, and isolation of plant constituents. 1 hr. lect., 2-4 hr. lab.

Pharmacy

390. **Special Problems in Pharmaceutical Sciences.** 1-3 hr. Where special interest is shown by the student in an area other than that of his thesis research, a faculty member will supervise individual study and research. 1-3 hr. lab.
391. **Seminar in Pharmaceutical Sciences.** 1 hr. Presentation and discussion of special topics and research in the pharmaceutical sciences.
497. **Research.** 1-15 hr.

Pharmacy Administration

320. **Drug Regulation and Control.** 3 hr. A detailed study of legislation affecting the development, introduction, control, and utilization of drugs in the American economy. 3 hr. lect.
321. **Drug Distribution Systems.** 3 hr. A detailed study and analysis of drug distribution in institutional environments. 3 hr. lect.
323. **Economics of the Pharmaceutical Industry.** 3 hr. The history, background, and formation of major drug industries. Topics include oligopolistic practices, mergers, combines, costs of research, and production. 3 hr. lect.

Medical Center Courses Open to Graduate Students

Anatomy

Anat.

301. **Gross Anatomy of the Trunk.** (For Medical and Graduate students.) I. 5 hr. PR: Consent. A gross anatomical study of the back, thorax, abdomen, pelvis, and perineum.
302. **Gross Anatomy of the Head and Neck.** (For Medical and Graduate students.) II. 3 hr. PR: Consent. A gross anatomical study of the head and neck.
304. **Gross Anatomy of the Extremities.** (For Medical and Graduate students.) II. 2 hr. PR: Consent. A gross anatomical study of the upper and lower extremities.
305. **Microanatomy and Organology.** (For Medical and Graduate students.) I. 6 hr. PR: General biology or equiv. and consent. Structure and function of cells, tissues, and organs.
306. **Gross Anatomy.** (For Dental and Graduate students.) I and II. 4 hr. per sem.; total of 8 hr. PR: General biology and consent. A study of the human body including dissection.

308. **Neuroanatomy.** (For Dental students, Graduate students, Physical Therapy students, and other health science students.) II. 2 hr. PR: Consent. A study of the gross and microscopic structure of the central nervous system. See also Neurobiology, Conjoined Course 375.
309. **Microanatomy and Organology.** (For Dental and Graduate students.) I. 6 hr. PR: General biology. Structure, function, and embryology of tissues and organs with emphasis on teeth and supporting structures.
314. **Applied Anatomy.** I, II. 2-6 hr. per sem. PR: Consent. A detailed study of anatomy adapted to the needs of the individual student.
399. **Selected Experiences in Anatomy.** I, II, S. 1-12 hr. Studies on special topics which will be determined in consultation with the instructor. PR: Anat. 301 or 306; 305 or 309, and consent.
401. **Advanced Gross Anatomy.** I, II. 2-6 hr. per sem. PR: Anat. 301, 302, 304, or 306, and consent. A morphological and functional analysis of a selected region. With dissection.
402. **Advanced Developmental Anatomy.** II. 2-4 hr. per sem. PR: Anat. 301 or equiv., and/or consent. Detailed developmental anatomy of the fetal period and infancy. With dissection and analysis of variations and malformations.
403. **Seminar.** I, II. 1-6 hr. 1 hr. per sem. Course may be repeated. PR: Consent. Presentation and discussion of special topics of current or historical interest.
405. **Experimental Embryology.** II. 3 hr. PR: Embryology and cellular physiology or biochemistry and consent. An analysis of development, differentiation, and regeneration. Offered in alternate (odd numbered) years.
406. **Advanced Neuroanatomy.** I. 2-4 hr. per sem. PR: Conjoined Course 375 and consent. A detailed study of selected areas of the brain and spinal cord. Offered in alternate (odd numbered) years.
407. **Advanced Study of the Autonomic Nervous System.** I. 2-4 hr. PR: Conjoined Course 375 and consent. Special topics on the peripheral autonomic nervous system and central areas of integration. Offered in alternate (even numbered) years.
408. **Histochemistry.** S. 3-4 hr. PR: Anat. 305 or 309, biochemistry, and consent. An introduction to histochemical theory and techniques. Offered (alternate summers, odd years.)
451. **Advanced Microanatomy and Organology.** II. 2 hr. PR: Anat. 305 or 309 and consent. An extension of the major topics included in Anat. 305 or 309, with special emphasis on recent contributions.
497. **Research.** I, II, S. 1-15 hr. PR: Consent. May be repeated as needed with consent of the Graduate Committee.

Biochemistry

Biochem.

231. **General Biochemistry.** II. 7 hr. PR: Inorganic Chem., Organic Chem., and consent. (A. Lectures and conferences. B. Laboratory, demonstration and conference for medical, dental, and graduate students—3 hr.)
239. **Clinical Chemical Techniques.** Primarily for Medical Technology students.) II. 4 hr. PR: Biochem. 139, 231, or equiv. Open to other qualified students.

337. **Biochemistry of the Amino Acids and Proteins.** I. 3 hr. PR: Biochem. 231 or equiv., consent. Offered in 1973-74 and alternate years.
339. **Seminar in Biochemistry.** I, II, S. 1 hr. PR: Biochem. 231 or equiv., consent. Presentation and discussion of special topics.
399. **Special Topics.** I, II, S. 1-12 hr. PR: Consent.
405. **Lipid Biochemistry.** I. 3 hr. PR: Agr. Biochem. 291 or Med. Biochem. 231, and consent. A consideration of the chemical and physical properties of the various classes of lipids and their biochemical and physiological pathways within the cell and cellular particulates. Offered in 1973-74 and alternate years.
423. **Immunochemistry.** I. 2 hr. PR: Biochem. 231. A study of the biosynthesis, chemistry, and biological properties of proteins important in immunology. Offered in 1972-73 and alternate years.
430. **Biochemical Preparations.** I, II, S. 2-5 hr. PR: Biochem. 231 or equiv., consent. Emphasis on biochemical methods.
432. **Enzyme Kinetics.** II. 3 hr. PR: Biochem. 139, 231, or equiv., and consent. An introduction to the physical mechanisms of enzyme action.
497. **Research.** I, II, S. 1-15 hr.

Microbiology

Microbiol.

220. **Microbiology.** II. 4 hr. (For Pharmacy students.) PR or Conc.: Biochemistry. A study of pathogenic microorganisms including immunology and antimicrobial agents.
223. **Microbiology.** II. 5 hr. (For Medical Technology students; Graduate students with consent.) PR or Conc.: Organic Chemistry. Basic microbiology with emphasis on immunology, pathogenic microorganisms and clinical laboratory techniques.
224. **Parasitology.** II. 4 hr. (For Medical Technology students.) Study of animal parasites and vectors of disease.
301. **Microbiology.** I. 4-7 hr. (For Medical and Graduate students.) (4 hr. for Graduate Students taking only the lectures). PR: Organic Chemistry, Biochemistry. A detailed study of pathogenic microorganisms.
302. **Microbiology.** I. 5 hr. (For Dental students.) PR: Organic Chemistry. A detailed study of pathogenic microorganisms with emphasis on oral flora.
316. **Basic Microbiology.** I. 4 hr. (For Graduate students.) PR: Organic Chemistry; biology recommended; consent. A detailed review of the major groups of microorganisms including morphology and physiology.
317. **Special Problems in Microbiology.** I, II, S. 1-6 hr. per sem. with a total of 24 hr. available. PR: Microbiol. 316 or equiv. Graded as U or S.
318. **Diagnostic or Determinative Microbiology.** I, II, S. 1-6 hr. per sem. with a total of 24 hr. available. PR: Microbiol. 316 or equiv. Graded as U or S.
319. **Comparative Cytology.** II. 4 hr. PR: Microbiol. 320; consent as limited enrollment. Basic features in structure and function of animal, plant, and microbial cells and their organelles. Projects in electron microscopy.
320. **Electron Microscopy.** I. 2 hr. PR: Consent, as limited enrollment. Introduction to preparation techniques and operation of the electron microscope.

321. **Bacterial Physiology.** I. 3-4 hr. (lect. 3 hr.; with lab. 4 hr.) PR: Microbiol. 316 or equiv.; Organic Chemistry; Biochemistry or conc. Physiological studies on bacteria including nutrition, metabolic pathways, growth, and death.
322. **Microbial Genetics.** II. 4 hr. PR: Microbiol. 316 or equiv.; consent. This course describes microbial mutation and adaptation, bacterial gene transfer mechanisms, and cytoplasmic inheritance.
323. **Immunology.** II. 4 hr. PR: Microbiol. 316 or equiv. A thorough study of antigens, antibodies, and their reactions both *in vitro* and *in vivo* with emphasis on theoretical and experimental problems.
324. **Virology.** II. 4 hr. PR: Microbiol. 316 or equiv.; Biochemistry. A comprehensive study of the basic biology of human, animal, and bacterial viruses.
325. **Medical Mycology.** I. 4 hr. PR: Microbiol. 316 or equiv. A study of fungi pathogenic for man and animals.
326. **Seminar.** I, II, S. 1 hr. PR: Microbiol. 316 or equiv. This will include the history of microbiology. Graded as U or S.
327. **Parasitology.** II. 4 hr. (For Graduate students.) Study of animal parasites and vectors of disease.
497. **Research.** I, II, S. 1-15 hr. PR: Microbiol. 316 or equiv. Students may enroll more than once. Graded as U or S.

Pathology

Path.

328. **Pathology.** (For Dental students.) II. 4 hr. PR: Microscopic Anat. 209. A study of disease processes with emphasis on fundamentals.
350. **Pathology.** II. 4 hr. Hematology.
352. **Clinical Pathology.** (For Medical students, second year.) II. 5 hr. PR: Consent. A study of all topics relating to clinical pathology: hematology, fluid and electrolytes, clinical microscopy, serology, and blood banking.
353. **Oral Pathology.** (For Dental students.) I. 3 hr. A study of the disease processes of the oral structures.
354. **General Pathology.** (For Medical students, second year.) Yr. 10 hr. PR: Consent. Includes gross and microscopic studies with demonstrations.
355. **Advanced Oral Pathology.** I, II. 1-3 hr. PR: Consent. Advanced seminar and laboratory study of local and systemic disease processes affecting the oral structures.
356. **Advanced Pathology.** I, II. 3 hr. PR: Path. 328 or 354, and consent. Microscopic and gross specimens for selected autopsies.
497. **Research.** I, II. 1-15 hr. PR: Consent.

Pharmacology

Pharmacol.

261. **Pharmacology.** (For Pharmacy students and Graduate students.) I. 5 hr. PR: Physiology. Lecture and laboratory course dealing with the principles, clinical applications, and laboratory methods in pharmacology.

360. **Pharmacology.** (For Dental and Graduate students.) I. 4 hr. PR: Physiology. Lecture and laboratory work dealing with the pharmacologic actions and therapeutic uses of drugs.
361. **Pharmacology.** (For Medical students (Second Year), and Graduate students.) II. 6 hr. PR: Physiology. Lecture-conference-laboratory course covering the general principles, pharmacodynamic actions, and therapeutic applications of clinically useful drugs.
363. **Toxicology.** II. 1 hr. PR: Consent. A study of the toxicological effects of official and non-official drugs and other harmful agents with special emphasis on symptomatology and treatment of the effects of economic poisons.
364. **Advanced Pharmacology.** I. 1-6 hr. PR: Pharmacol. 361 or equivalent. Advanced lectures in specialized areas of pharmacology.
365. **Advanced Pharmacology.** II. 1-6 hr. PR: Pharmacol. 361 or equiv. Advanced lectures in specialized areas of pharmacology.
366. **Advanced Pharmacology (Laboratory in Drug Evaluation).** S. 1-3 hr. PR: Consent. A study of laboratory procedures and demonstrations in assessing drug action.
460. **Special Topics in Pharmacology.** I, II, S. 1-6 hr. per sem. Assigned study on an individual basis for advanced students.
461. **Seminar in Pharmacology.** I, II. 1 hr. per sem. PR: Pharmacol. 361 or graduate status in basic medical sciences.
462. **Literature Survey.** I, II. 1 hr. per sem. PR: Graduate status in pharmacology. A survey of the current literature pertinent to the field of pharmacology including journals of allied biological sciences.
463. **Preceptorship.** I, II. 1-2 hr. per sem. PR: Pharmacol. 361 and consent. A critical evaluation of the preparation and delivery of lectures in specified areas of pharmacology. For advanced graduate students.
497. **Research.** I, II, S. 1-15 hr.

Physiology and Biophysics

Physiol.

244. **Introduction to Biophysics.** (Advanced Undergraduate and Selected Graduate students.) S. 3 hr. PR: General Physics and Calculus or consent. Designed to provide introduction to: theory and application of instrumentation, bioelectricity, biophysics of special senses, radiation biology, and control systems.
248. **Experimental Design.** (Advanced Undergraduate and Selected Graduate students.) I, II, S. 3 hr. PR: Consent. Theory and practical experience in design of experiments and processing of physiological data using small laboratory digital computers. 1 lect., 2 lab.
343. **Fundamentals of Physiology.** (Dental and Graduate students.) I. 5 hr. PR: College Physics, Algebra, and Chemistry. Analysis of basic facts and concepts relating to cellular processes, organ systems, and their control. 3 lect., 1 conf., 1 lab.
345. **Medical Physiology.** (Medical and Graduate students.) I. 6 hr. PR: College Physics, Algebra, and Chemistry. Analysis of basic facts and concepts relating to cellular processes, organ systems, and their control, with clinical correlations. 4 lect., 1 conf., 1 lab.

346. **Neurophysiology.** (Medical and Graduate students.) II. 3 hr. PR: College Algebra, Physics. Properties of excitable tissues (nerve and muscle), synaptic transmission, reflexes and central nervous system function, and behavior. 2 lect., 1 conf.
347. **Biophysical Analysis.** II. 4 hr. (Alternate Years.) PR: Math. 17 (Calculus III) and Physiol. 345 or consent. Introduction to "Systems Biophysics," the methods of analysis and their application in the quantitative study of biological phenomena. 3 lect., 1 conf. -seminar.
399. **Special Topics.** I, II, S. 1-4 hr. PR: Consent. Assigned study designed to develop research skills.
441. **Physiological Methods.** II. 4 hr. PR: Physics 113, 114 or equiv. Theory and application of technics essential to acquisition and processing of physiological data. 2 lect., 2 conf. -lab.
442. **Advanced Physiology.** I. 4 hr. PR: Math. 16 (Calculus II) and Physiol. 345 and 346. Lecture-seminar in physiological and biophysical topics with emphasis on recent and quantitative developments. 2 lect., 2 conf. -seminar.
443. **Advanced Physiology.** II. 4 hr. PR: Math. 16 (Calculus II) and Physiol. 345 and 346. Lecture-seminar in physiological and biophysical topics with emphasis on recent and quantitative developments. 2 lect., 2 conf. -seminar.
444. **Graduate Seminar.** I, II. 1 hr. PR: Graduate status and consent.
446. **Cellular Biophysics.** I. 4 hr. (Alternate Years.) PR: Math. 16 and Physical Chemistry. Thermodynamics of membrane transport, biophysics of excitable tissues (nerve, muscle, receptors) and non-excitable tissues (frog skin, secretory and red blood cells, etc.). 2 lect., 2 conf.-seminar.
447. **Systems Biophysics.** II. 4 hr. (Alternate Years.) PR: Physiol. 347 or consent. A quantitative analysis of physiological regulatory systems. 2 lect., 2 conf. -seminar.
497. **Research in Physiology and Biophysics.** I, II, S. 1-15 hr.

Conjoined Basic Sciences Courses

(In the curricula of the Basic Sciences in the Medical Center, certain courses are conducted on non-departmental or interdepartmental lines. These have been designed as Conjoined Courses.)

314. **Medical Human Growth and Development.** (For Medical and Graduate students.) II. 1 hr. PR: Consent. Basic considerations of embryology, organogenesis, teratology, and other factors influencing intrauterine growth and development and the adaptation of the fetus to extrauterine life.
322. **Medical Statistics.** (For Medical and Graduate students.) I. 1 hr. PR: Consent. An introduction to the statistical analysis of biologic phenomenon as related to medicine.
370. **Medical Genetics.** (For Medical and Graduate students.) II. 1 hr. PR: Consent. An introduction to the understanding of genetics and heritable diseases in man.
375. **Neurobiology.** (For Medical and Graduate students.) II. 6 hr. PR: Anat. 301 and Physiol. 345, or consent. A study of the anatomy and physiology of the nervous system correlated with clinical neurology.

399. **Selective Experiences in Medicine.** Fourth year. I, II, S. CR. PR: Satisfactory completion of first three years of medical curriculum. Graded as S or U. The selective program for fourth-year medical students offers a wide range of opportunities, in the basic sciences, medical specialties and sub-specialties, and in family practice. The year is composed of twelve four-week blocks. Six are spent at the WVU Medical Center in Morgantown. The remainder may be spent at community hospitals in West Virginia, or at university or university-affiliated hospitals out-of-state. Each student plans his individual program, with faculty advice. Flexibility is permitted. With consent from the instructors concerned, the student may, during the year, alter his selective choices. He must give two weeks' notice before changing an intramural selection, and four weeks' notice before changing an extramural or an out-of-state selection. (See intramural and extramural folders, published annually, describing the selective opportunities.)

School of Journalism

The School of Journalism offers graduate study leading to the degree of Master of Science in Journalism. The purpose is to offer the student already well prepared with journalism skills and knowledge the opportunity to educate himself further in problems of mass communication and society. He may acquire further critical insight into methods, theories, and practices appropriate to the problems of his profession. He may improve his professional skills and his knowledge about topics of social concern.

The Thesis Research Program tends to concentrate on research methods and theory as they apply to communications problems.

The Professional Program emphasizes the sharpening of skills and the broadening of knowledge the professional journalist requires in carrying out his responsibility to our complex society.

An individualized program is designed for each student according to his needs and goals.

Writing quality and independent study are emphasized throughout.

Admission

For admission to graduate study in journalism, the applicant must meet the following requirements:

a. Hold a baccalaureate degree in journalism from an accredited institution or

b. Hold a baccalaureate degree in another field from an accredited institution and meet one of the following requirements:

(1) Have completed a core of journalism courses with subjects and grades acceptable to the School of Journalism or

(2) Complete the undergraduate journalism courses to be prescribed by the School of Journalism or,

(3) Demonstrate knowledge and competence in a number of journalism topics to be prescribed by the School of Journalism or,

(4) Meet a combination of the foregoing requirements.

c. Provide letters testifying to academic motivation and, where appropriate, to professional development.

d. Have a cumulative grade-point average of at least 2.5 (out of possible 4.0) in undergraduate study, with a cumulative grade-point average of 3.0 in journalism courses completed, undergraduate and graduate.

e. A professional journalist whose undergraduate record does not meet requirements of the School of Journalism will be considered for probationary admission upon presentation of letters and other evidence attesting to a year or more of commendable professional development.

f. Foreign students are offered a transition semester. Believing that mutual benefit is derived when students from other countries study with the WVU School of Journalism, the School welcomes foreign students. At the same time, this School recognizes that to profit by journalism study and practice here the student must have a ready understanding of the American language idiom. He will be called on to follow rapid speech in interviews, press conferences, public addresses, and in the classroom. Therefore, for the foreign student holding a journalism degree but to whom English is a foreign language, the first semester will be probationary. In this semester the faculty and the student will discover whether his language facility is adequate for him to benefit from journalism graduate study. If his English language requires strengthening, he may be requested to complete appropriate undergraduate courses. In this introductory phase, the student will progress in adapting to the American system of journalism.

The Degree of Master of Science in Journalism

For the master's degree in journalism, the student must meet the following requirements:

Thesis Research Program. A minimum of 30 semester hours of acceptable graduate credit including a thesis for a maximum of 6 hours of credit.

a. As part of the 30 hours, a minimum of 18 hours, including the thesis, in School of Journalism courses.

b. Included in the 30 hours, a minimum of 9 hours in a minor conducted outside the School of Journalism.

Professional Program. A minimum of 36 semester hours of acceptable graduate credit including a professional project for a maximum of 6 hours of credit.

a. As part of the 36 hours, a minimum of 18 hours, including the professional project, in School of Journalism courses.

b. Included in the 36 hours, a minimum of 9 hours in a minor conducted outside the School of Journalism.

Upper-Level Courses Required. In both programs, 60 per cent of the graduate credits submitted for the degree must be in courses numbered 300 or above.

Grades. Course work must be completed with a minimum grade-point average of 3.0 (out of possible 4.0). The thesis and the professional project will be graded S or U.

Examination. The candidate shall be required to pass an oral examination on his thesis or professional project and on competence in his major and minor fields.

Journalism

Journ.

203. **Media Management and Promotion.** I, II, S. 3 hr. PR: Journ. 113 and 115. Problems, functions, and responsibilities in communications media organization, operation, management, and promotion. Special emphasis on case study of media management and promotion in the Appalachian area.
204. **Advertising Markets and Media.** I, II, S. 3 hr. PR: Journ. 113. A study of advertising planning, buying, and scheduling by advertisers, media, and advertising agencies on national and local levels. Seminar discussions and assignments with special emphasis on problems related to Appalachian markets and media.
210. **Advertising Production.** II. 3 hr. PR: Journ. 110. Techniques and mechanics of producing print advertising. Study includes art, typography, printing processes, layout, and make-up. Student must acquire tools and supplies for lab work; cost: about \$10.00.
220. **Feature Writing and Marketing.** I, II. 2 hr. An advanced seminar in writing, editing, and marketing of newspaper features and magazine articles. Competence in basic English composition is a prerequisite.
221. **Public Relations Interning.** II. 3 hr. Open only to junior, senior, and graduate public relations majors. Here the student learns through on-the-job training and from reports of those who have on-the-job experience. Course is structured along a public relations agency organization and operations.
227. **History of Journalism.** I, S. 3 hr. PR: Hist. 52 and 53 or consent. Open to all University students. A study of the impact of the American press on the nation; the development of today's communications media from the beginnings in seventeenth century England and in the American colonies; an examination of the great names in journalism from the

standpoint of their contributions to today's journalism; freedom of the press and its current implications.

228. **Law of the News Media.** II. 3 hr. For seniors and graduate students. A study of the law as it affects the mass media. Considered are such areas as libel, public records, criminal pre-trial publicity, freedom of information, obscenity.
230. **Editorial and Interpretive Writing.** I, II. 3 hr. Open to all University students. The student will analyze and write editorials and commentaries. He will study typical editorial pages and the ethics governing editorial page content. He will also become familiar with libel, privacy, contempt, and other problems—operating and political—as they arise.
251. **Direct Mail Advertising.** I, II. 3 hr. PR: Journ. 113 and 114 or consent. Two lec. and one lab. period. A study of mailing, marketing, and creation of direct mail letters, brochures, involvement pieces, and reply cards. Also a study of postal regulations, direct mail law, and printing procedures.
281. **Public Affairs Programing.** I. 3 hr. PR: Journ. 183 or consent. The basic principles of evaluating and documenting public issues into television and radio presentation form. Includes methods of program selection, research, writing, sources and type of content materials.
282. **Public Affairs Programing.** II. 3 hr. PR: Journ. 281. Continuation of Journ. 281. An in-depth laboratory course in actual preparation of materials for inclusion in public issues programs. Work includes filming and recording interviews, background materials, obtaining and selecting supporting sound, music, art.
286. **Radio and Television Advertising.** I. 3 hr. PR: Journ. 113 or Speech 184 and consent. Development of radio and television writing techniques. Media planning, buying, and market analysis. Federal regulations affecting advertising in broadcast media.
289. **Documentary Motion Picture Production.** II. 3 hr. PR: Journ. 189 and Journ. 281 or Speech 184 and Speech 280. An in-depth development of the techniques and resources utilized in the production of a complete documentary motion picture. Areas of study include films, processing, cinematography, editing, research, writing, music, narration. Laboratory-oriented. (Also listed as Speech 289).
299. **Contemporary Media Issues and Ethics.** I, II. 3 hr. Required of all senior journalism majors. An in-depth study of contemporary media issues such as right of access to media, morality in news and advertising, newspaper preservation act, government officials' criticism of the media, social responsibility of media professionals. Individual research papers on issues with ethical considerations.
302. **Seminar in Communications Theory.** II. S. 3 hr. A study of communications theories and problems of contemporary mass media.
312. **Seminar in Institutional Relations.** II. 3 hr. A study of the problems of public relations and public information officers of educational institutions of higher learning and public service organizations; thorough study of the publics which these officers attempt to reach.
315. **Seminar in Journalism Education.** I, S. 1-3 hr. Discussion of journalism education problems. Each student will do an individual research project planned to provide for his professional development as a teacher of journalism. Emphasis on secondary school problems.

- 339. **Seminar in Advanced Advertising Management Problems.** II. 3 hr. Recently developed ideas and techniques in advertising, advertising research, and media management.
- 341. **Special Topics.** I, II, S. 1-6 hr.
- 343. **International Communications.** I. 3 hr. International news gathering and dissemination—including wire services, broadcast satellites, and political barriers—will be examined, particularly as these factors affect a free exchange of information within the world community. Efforts by the United Nations to encourage news exchange and to lower news barriers will be a major case examination.
- 344. **Seminar in the Foreign Press.** II. 3 hr. Studies in legal and communications problems of the international flow of news and opinion; international press codes; communications media of major countries.
- 380. **Thesis.** I, II, S. 2-6 hr.
- 401. **Research Methods and Literature.** I, S. 3 hr. A study of methods common to communications research; critical examination of communications literature; the mass media; problems of communicating with the various publics; general independent research projects by each student.
- 422. **Seminar.** I, II, S. 1-4 hr.
- 497. **Research.** I, II, S. 1-15 hr.

School of Mines

The School of Mines offers graduate curricula leading to the Master of Science degree in two fields: mining engineering and petroleum engineering. A student desiring to take courses for graduate credit in the School of Mines must first apply for admission to the Graduate School, and state the major field of his choice.

An applicant with a baccalaureate degree or its equivalent in the major field corresponding to the graduate study desired, from a department accredited by the Engineers' Council for Professional Development, will be admitted on the same basis as graduates of WVU. Lacking these qualifications, an applicant must first fulfill the School of Mines' requirements in the field in which he is seeking an advanced degree.

Approval for candidacy for a graduate degree by faculty action is required to establish eligibility for a degree. A graduate student may request approval by formal application after completing a minimum of 12 semester hours of graduate courses with a grade-

point average of at least 3.0 (B), based on all graduate courses in residence for which final grades have been recorded.

Academic Standards. No credits are acceptable toward an advanced degree which are reported with a grade lower than "C." To qualify for an advanced degree, a graduate student must have a grade-point average of at least 3.0 based on all courses completed in residence for graduate credit. Each candidate for a degree must select a major subject and submit a thesis showing marked attainment in that field.

Engineering of Mines

E.M.

200. **Elements of Mineral Conservation.** I. 3 hr. PR: Open to any student in the University with junior standing. A study of the future demands for mineral resources including coal, water, oil, gas, ores, and industrial minerals and the causes of mineral loss in production and utilization and how to avoid or minimize them.
201. **Fire Control Engineering.** II. 3 or 4 hr. PR: Senior standing in an engineering curriculum or consent. The aspects involved in the control from fire, explosion and other related hazards. Protective considerations in building design and construction. Fire and explosive protection organization including fire detection and control. Lectures (3) and/or 3 hr. lab.
207. **Introductory Seismology.** I. 1 hr. PR: Physics II. Earthquakes and the causes and area distribution; theory of elastic waves; the principles of seismograph construction, adjustment, and operation, interpretation and calculation of seismograms with exercises provided by records of the University seismograph station. 1 hr. lec.
209. **Mineral Preparation.** II. 3 hr. PR: T.A.M. 52, C.E. 115, or consent. Principles of preparation, beneficiation, and concentration of metallic, and non-metallic ores for further processing or utilization. 2 hr. lec., 3 hr. lab.
212. **Advanced Mining.** II. 3 hr. PR: E.M. 108 and PR or conc.: E.E. 105. Engineering principles, methods and equipment applied to mine transportation, hoisting, and drainage. 3 hr. lec.
213. **Mine Ventilation.** I. 3 hr. PR: E.M. 108, T.A.M. 52, and C.E. 115. Principles, purposes, methods and equipment pertaining to the ventilation of mines. 2 hr. lec., 3 hr. lab.
215. **Industrial Safety Engineering.** I. 3 hr. PR: Junior standing or consent. Analysis of problems of industrial safety and accident prevention, laws pertaining to industrial safety and health, compensation plans and laws, and industrial property protection. 2 hr. lec.
217. **Coal Preparation.** I. 3 hr. PR: E.M. 108, 209, or consent. Formation of coal, rank, classification of coal, coal petrography, principles of preparing and beneficiating coal for market with laboratory devoted to sampling, screen analysis, float and sink separation, and use of various types of coal cleaning equipment. 2 hr. lec., 3 hr. lab.
218. **Advanced Mineral Preparation.** I. 3 hr. PR: E.M. 209. The theory and practice of concentration of ores, and industrial minerals with special consideration to the more recent advances in the beneficiation of both ores and coal. 2 hr. lec., 3 hr. lab.

219. **Advanced Mining Methods for Vein Deposits.** II. 3 hr. PR: E.M. 108, T.A.M. 52. Methods and systems of mining other than flat seams. Emphasis placed on selection of methods in relation to cohesive strength of ore bodies and their enclosing wall rocks. Mining of anthracite is included. 3 hr. lec.
220. **Mine Design.** I, II. 3 hr. PR: E.M. 212, E.M. 241. A comprehensive design problem involving underground mining developments or design of surface plant or both, as elected by the student in consultation with the instructor. A complete report on the problem is required including drawings, specifications, and cost analysis. 9 hr. lab.
222. **Mine Equipment and Machinery.** II. 3 hr. PR: E.E. 106 and E.M. 212. Selection, installation, operation, and maintenance of mining equipment. 3 hr. lec.
223. **Mine Management.** II. 3 hr. PR: Math. 18, E.M. 108, 212 and senior standing. Economic, governmental, social, and labor aspects of mining as related to the management of a mining enterprise. 3 hr. lec.
224. **Mining Engineering Problems.** I, II. 1-6 hr. PR: Senior or graduate standing or by consent. Special problems in mining engineering, including choices among operations research, mine systems analysis, coal and mineral preparation, and coal science and technology.
228. **Mine Equipment and Machinery Controls.** I. 3 hr. PR: E.M. 222 or consent. Principles, application and use of electric and hydraulic devices and circuits for protection and control of mine machinery and equipment. 3 hr. lec.
- 229 **Advanced Mining Equipment Applications.** II. 3 hr. PR: E.M. 228. Structural, mechanical, hydraulic and electrical characteristics of the more common items of mining equipment. Controls, electrical and hydraulic circuits, and mechanical transmissions with associated problems. Laboratory design of a control system for a mining machine. 2 hr. lec., 3 hr. lab.
230. **Elements of Geophysical Prospecting.** I. 3 or 4 hr. PR: Geol. 1, Physics 11. Principles, calculations and application of methods for locating sub-surface oil, gas, and mineral deposits. Field investigation using instruments with 4 hr. section.
241. **Mechanics of Ground Control in Mines.** I. 3 hr. PR: T.A.M. 52, Math. 18, E.M. 108 or consent. Structure of the earth's crust, bedding planes, joints, heterogeneity, mechanical properties of rocks, stress-time-deformation relationships in rocks, theoretical stress distribution about mine openings, practical effects, factors in mine pillar design, pillar bursts, creeps and squeezes, mining subsidence. 2 hr. lec., 3 hr. lab.
- 301, 302. **Advanced Mine Design.** I, II. Credit arranged. Advanced detail design and layout of coal mine plant, particularly incorporating new ideas of machines and mining methods.
351. **Coal Mining.** S. 3 hr. PR: Chemistry, 10 hr.; Physics, 8 hr.; and accompanied or preceded by general geology. Especially for students who are planning to teach mining subjects in high school. Not open to students taking E.M. 108 or 212. Hours arranged.
- 395, 396. **Graduate Seminar in Coal Mine Operation and Administration.** I, II. 3-6 hr. PR: B.S. degree and consent of Committee. Group discussion and analysis of problems related to the production, preparation, market-

ing, and utilization of coal with special assignments and emphasis in accordance with personnel background and field of interest of the individual student.

497. **Research.** I, II. 1-15 hr.

Petroleum Engineering

Pet.E.

207. **Natural Gas Engineering.** I. 4 hr. PR: Pet.E. 106, C.E. 115. Principles of natural gas production, transmission, distribution, processing, regulation, measurement, storage and analysis with a laboratory devoted to the principles of the equipment utilized in the above named operations. 3 hr. lec., 3 hr. lab.
210. **Drilling Engineering.** I. 3 hr. PR: Geol. 1, Math. 18, C.E. 115, I.E. 213, 281. Rock properties, well-bore hydraulics, air and gas drilling factors affecting penetration rate, slim-hole, lifting capacity liquid air or gas, two-phase flow, casing and casing string design, well-bore primary and squeezing cementing, minimum cost drilling. 3 hr. lec.
211. **Production Engineering.** II. 3 hr. PR: Pet.E. 210. Performance of productive formation, drill stem tests, completions of wells, flowing wells, gas lift methods and equipment, pumping installation design, well stimulation, emulsion, treating, gathering and storage of oil and gas, field automation. 3 hr. lec.
212. **Drilling Fluids Laboratory.** II. 1 hr. PR: Pet.E. 210. Chem. 141, C.E. 115. Drilling fluids control relative to pilot testing, drilling fluid design procedures and measurement of composition and properties. 1 hr. lab.
216. **Petroleum Engineering Design.** II. 2-3 hr. PR: Pet.E. 232, Material Engr. 250. A comprehensive problem in design involving systems in oil and gas production, field processing, transportation and storage. Three 3-hr. labs.
224. **Petroleum Engineering Problems.** I, II. 1-6 hr. PR: Senior or graduate standing. Investigation and detailed report on a special problem in petroleum or natural gas engineering. Supervised by a member of the graduate faculty.
233. **Elements of Petroleum Reservoir Engineering.** II. 3 hr. PR: Pet.E. 236. Introduction to the basic properties of petroleum reservoir rocks. Fluid flow through porous materials. Evaluation of oil and gas reserves. 3 hr. lec.
234. **Applied Petroleum Reservoir Engineering.** I. 3 hr. PR: Pet.E. 233. Application of reservoir engineering data to the calculation of recovery potentials and to the analysis, simulation and prediction of reservoir performance under a variety of production methods to effect maximum conservation. 3 hr. lec.
235. **Formation Evaluation.** II. 3 hr. PR: Math. 17, Pet.E. 210 or consent. Principles of the various well logging methods and related calculations with exercises in interpretation of data from actual well logs. 2 hr. lec., 3 hr. lab.
236. **Mechanics of Hydrocarbon Fluids.** I. 3 hr. PR: Physics 12, C.E. 115, E.M. 102, Pet.E. 106, Chem. 141. The qualitative and quantitative phase behavior of single and multicomponent hydrocarbon systems with emphasis on application to petroleum production engineering and petroleum reservoir engineering. 2 hr. lec., 3 hr. lab.

240. **Secondary Recovery of Oil by Water Flooding.** II. 3 hr. PR: Pet.E. 234. Theory of immiscible fluid displacement mechanism, evaluation and economics of water flood projects, and oil field flooding techniques. 3 hr. lec.
241. **Petroleum Management Engineering.** II. 4 hr. PR: Pet.E. 211, 234, 235, Econ. 52. Petroleum property evaluation, factors influencing oil economics, values of money and taxation of oil properties. Calculation of reserves and future reservoir performance, decline curves, production and formation testing and special aspects of management of oil and gas properties. 4 hr. lec.
242. **Well Stimulation: Fracturing.** I. 3 hr. PR: Pet.E. 106, 241. Theory of hydraulic fracturing, fracturing tools, fracturing fluids, fracturing orientation; propping agents and general design treatment for optimum profitability. 3 hr. lec.
243. **Advanced Secondary Recovery.** I. 3 hr. PR: Pet.E. 240. Theory and practice of secondary recovery of oil by gas flooding, miscible fluid injection, in situ combustion, and heat injection. 3 hr. lec.
244. **Petroleum Reservoir Engineering Laboratory.** II. 1 hr. PR: or Concurrent: Pet.E. 233. Laboratory evaluation of basic and special petroleum reservoir rock properties.
301. **Advanced Petroleum and Natural Gas Engineering Design.** I, II. Credit arranged. Advanced detail design problems in some phase of petroleum and natural gas exploration, production, and transportation, particularly incorporating new ideas, machines and methods.
302. **Fluid Flow in Porous Media.** I. 3 hr. PR: Pet.E. 232 and Math. 140 or consent. Intensive study of theoretical and practical aspects of the physical principles of hydrodynamics in porous media. 3 hr. lec.
497. **Research.** I, II. 1-15 hr.

School of Physical Education

Graduate students in the School of Physical Education pursue courses and scholarly tasks which lead to the Master of Science Degree in School Physical Education, the Master of Science Degree in Sport Studies, the Master of Science Degree in Safety Studies, the Certificate of Advanced Study in Physical Education or Safety Education, and the Doctor of Education Degree in Physical Education or Safety Education.

Admission to the School of Physical Education is contingent upon satisfying the requirements established by the Graduate School of WVU and the School of Physical Education. The potential graduate student must initiate admission procedures by submitting an application to the Dean of Admissions and Records. This application will then be forwarded to the Dean of the Graduate School and the Graduate Studies Committee of the School of Physical Education. Admission to the Graduate School does not constitute admission to candidacy for a degree in the School of Physical Education.

The Degree of Master of Science in School Physical Education or Sport Studies

The School of Physical Education offers courses leading to the Master of Science degree, with an emphasis in School Physical Education or Sport Studies.

Students are admitted for graduate work leading to the Master of Science degree in the School of Physical Education, provided they hold a baccalaureate degree from an approved institution of higher education; have a 2.75 undergraduate grade-point average (based on a 4.0-point system); and satisfy prerequisites in the courses for which they register.

Students who do not meet the 2.75 grade-point average requirement but exceed a grade-point average of 2.25 may be admitted on probation and will be required to earn a 3.0 average in the first 9 semester hours of residence work in order to continue.

Students are accepted as advanced degree candidates on the basis of a preliminary review examination following one semester, or two summer terms, (12 semester hours)* of graduate residence work provided they demonstrate to the satisfaction of the Com-

*Courses taken in University Extension are accepted for degree purposes provided the student has had prior approval from his adviser.

mittee on Graduate Study through a Preliminary Review Examination proficiency in the student's major interest area. In order to receive the degree the student must have a minimum of a 3.0 average in all course work leading toward the degree and satisfy all Graduate School requirements.

Thirty-six semester hours are required for the Master of Science degree, distributed as follows:

- I. Satisfactory completion of the disciplinary core courses for the Master of Science Degree. These courses are: P.E. 320, P.E. 340, P.E. 360, and P.E. 380
- II. In addition to the basic disciplinary core the student may elect to pursue either the curriculum devoted to School Physical Education or Sport Studies.
 - a. *School Physical Education*
 1. 12 semester hours of basic Physical Education core.
 2. 9 semester hours of professional physical education courses including P.E. 305, P.E. 445, and P.E. 497.
 3. 6 semester hours of required courses in professional education including Ed. 330 and Ed. 320.
 4. 9 semester hours elected in approved professional education courses or thesis.
 - b. *Sport Studies*
 1. 12 semester hours of basic Physical Education core.
 2. 6 semester hours in social research and statistics.
 3. 3 semester hours in P.E. 345.
 4. 9 semester hours elected from approved courses in psychology or sociology.
 5. 6 semester hours of thesis.

In the final semester of course work the candidate must successfully complete a comprehensive examination which is administered by the Graduate Studies Committee.

The Degree of Master of Science in Safety Studies

The School of Physical Education offers courses leading to the Master of Science Degree, with emphasis in Safety.

Degree Requirements

Students may be admitted for graduate work leading to the M.S. Degree in Safety Studies provided that a baccalaureate degree from an approved college has been completed in areas such as: business management, engineering, industrial arts, physical education, physical science, psychology-sociology, or safety. A 2.75 undergraduate grade-point average (based on a 4.0-point system) is expected. Otherwise, providing the grade-point average is at least 2.25, admission must be of probationary status which requires

the student to earn a 3.0 average on the first 9 semester hours of residence work in order to continue. Students are encouraged to complete the Aptitude Test of the Graduate Record Examination within the first 18 semester hours after matriculation. By this same time, students will be expected to have completed the following courses in Safety: 300, 310, 311, and 418 or equivalent.

A student is accepted as an advanced candidate for his degree providing course work and requirements previously mentioned are of a satisfactory nature as judged by the graduate committee of the department.

A candidate must complete a minimum of 36 credit hours including an approved research experience in safety to qualify as a degree recipient. A grade-point average of 3.0 will be required for graduation.

The general regulations of the Graduate School in regard to transfer and extension credit plus time limitations will be followed.

During the final term or semester of study, each student will be required to pass successfully an examination dealing with the core subject matter and specialization emphasis.

Courses in the required departmental "core" include: 300, 310, 311, 418, 472, and 497. Additional course work must be planned in consultation with the adviser. Electives are designed to enable fulfillment of interests and needs of both safety education and safety management professionals. Six semester hours of course work may be devoted to directed electives from one of the student's undergraduate major or minor fields or from a field allied to Safety. Approval by the adviser must be obtained prior to enrollment in such electives by students.

Certificate of Advanced Study Program

The program, in cooperation with the College of Human Resources and Education, is designed to prepare school and related personnel who wish professional education beyond the master's degree. Candidates for this Certificate may choose either Physical Education or Safety Education.

Prerequisites for Admission to the Program

1. General requirements for admission to the Graduate School of WVU.
2. A master's degree with a minimum grade-point average of 3.0.
3. A minimum of three years of teaching or related educational experience.

Entrance Requirements

Applicants who have received bachelor's and master's degrees from an accredited institution are eligible for admittance to the

Certificate of Advanced Study program. Applications for this program may be obtained from the WVU Office of Admissions and Records. Students will be admitted on the basis of their undergraduate and graduate transcripts of earned course credit. Upon admission to the University the student is automatically admitted to the program. If a person applies for consideration as a candidate for the Certificate of Advanced Study, and at some future date wishes to change the degree objective, it will be necessary to reapply to participate in the revised program.

Program Requirements

Upon admittance the student, in concert with the major adviser, will select an advisory committee consisting of two members of the Graduate Faculty from the School of Physical Education and one member of the Graduate Faculty from the Division of Education. This committee will aid the student in the construction of his or her program.

The program shall consist of a minimum of 30 course hours, wherein 6 of these hours must be earned by the successful completion of the Certificate of Advanced Study Final Scholarly Project. At least 24 semester hours of the work credited for this Certificate must be done in residence at WVU. This requirement includes the 6 hours of research which may be conducted apart from the physical limits of the University but must be done under the direction and supervision of the chairman of the student's graduate committee. A maximum of 6 semester hours earned in residence at another approved graduate institution or in WVU Extension may, if approved by the student's adviser, be allowed toward credit for the Certificate.

Final Requirements

Upon completion of the course work and the final scholarly project the student will orally defend his or her project in the presence of the advisory committee.

Time Limitation

All requirements must be completed within five calendar years immediately preceding the awarding of the Certificate.

The Degree of Doctor of Education In Physical Education or Safety Education

The degree of Doctor of Education is offered in cooperation with the College of Human Resources and Education.

Admission Procedures

Individuals who wish to pursue a program leading to the Doctor of Education degree must be admitted to the Graduate School of WVU. All applicants for admission to the doctoral program must submit scores on the Aptitude Test of the Graduate Record Examination, three letters of recommendation (one of which must be submitted by the applicant's immediate employment supervisor), a complete transcript of undergraduate and graduate education up to the time of application, and otherwise comply with each of the general regulations of the Graduate School outlined in Parts 1 and 2 of this Catalog. Whenever practical a personal interview with the members of the Graduate Studies Committee of the School of Physical Education is recommended. All materials and procedures must be complete by March 1.

Acceptance as an advanced graduate student will be contingent upon the Graduate Studies Committee decision regarding the applicant's potential for scholarly productivity as judged by the Graduate Record Examination scores, past performance in course work, letters of recommendation, and the personal interview. Applicants who satisfy the minimal standards for admission will be assigned a temporary adviser and will assume the status of an advanced graduate student.

Admittance to the Program Procedures

Within the semester the advanced graduate student is completing the eighteenth hour of resident course work he or she shall request, through the Office of the Chairman of the Graduate Studies Committee of the School of Physical Education, to become admitted to the program. This request may be made at anytime during regular sessions of the University.

Following the request of the advanced graduate student the Graduate Studies Committee will convene and decide upon admittance to or rejection from the program. The student need not be present at this meeting. In complex cases where a decision is difficult the student will be summoned to appear before the Committee for further deliberation.

Program Requirements

Once the student is admitted to the program he or she, in concert with the adviser, will select the student's advisory committee. This committee shall consist of three members of the Graduate Faculty of the School of Physical Education and two members of the Graduate Faculty of the College of Human Resources and Education. It will be the responsibility of this committee to aid the student in planning his or her total program. This

program shall contain a minimum of twenty-four hours in either Physical Education or Safety Education course work and a minimum of twenty-four hours in Education course work. During the process of completing a program the student is expected to fulfill a residency requirement which consists of a minimum of 9 semester hours of course work for each of two successive academic semesters.

Courses recommended as part of the degree program concentration in Safety include core courses not previously taken at the master's degree level, plus the following: Safety 452, 454, 457, and 459.

Suggested courses beyond the master's degree in the area of Physical Education which may be applied to the doctoral degree are P.E. 306, 365, 367, 425, 460, 465, and 480.

Admittance to Candidacy Requirements

As the student nears the termination of the course work application may be made to complete the final comprehensive examination. This examination shall consist of scholarly tasks designed to function as a comprehensive learning experience. The examination will be constructed by the student's advisory committee. The student shall be allowed to complete this examination one time and if unsuccessful may be permitted to recomplete the examination one more time upon an appeal and subsequent sanction of his or her advisory committee. There must be a time period of at least six months between the first and second examination periods.

Upon the successful completion of the final comprehensive examination the student may then present to his or her advisory committee a prospectus of the dissertation. If the opinion of the committee is such that the student may proceed with the dissertation he or she is admitted to candidacy.

Final Requirements

Upon the completion of the dissertation the candidate will appear before his or her advisory committee for purposes of orally defending the study. The successful defense of the dissertation results in the awarding of the degree.

Special Advanced Graduate Students

Provision is made within the School of Physical Education which would permit an individual to apply for admission as a special advanced graduate student. The individual who wishes to pursue this course of action must indicate this intention on the application form provided by the WVU Office of Admissions and Records. If a special advanced graduate student wishes to change his or her degree objective to that of the doctorate it will be

necessary to reapply for that particular program. If this transfer is effected the student may apply only 6 course hours of credit toward the doctoral program.

Physical Education

P.E.

- 278. **Administration of Physical Education.** I, II, S. 3 hr. PR: P.E. 71, 177. Modern theories in physical education and guiding principles in organization and administration.
- 300. **Workshop in Physical Education.** I, II, S. 1-15 hr.
- 305. **Philosophical Concepts in Physical Education.** I, S. 3 hr. PR: Graduate standing or consent. Study of educational philosophies and application of these philosophies to physical education; study of the place of physical education in education and modern living.
- 306. **Scientific Interpretations of Physical Education.** I, 3 hr. PR: Doctoral standing. A synthesis of the behavioral and biological sciences as a foundation for advanced study in the disciplinary content of sport science and physical education.
- 320. **Individual Interaction in Sport and Physical Activity.** I, S. 3 hr. PR: Graduate standing or consent. Designed to acquaint the student with the reciprocal relationships between sport and physical activity and the societies and cultures out of which sport emerges. It is an in-depth analysis of the study of sport utilizing sociological investigatory methods as frames of reference.
- 340. **Psychology of Sport and Physical Activity.** I, S. 3 hr. PR: Graduate standing or consent. Study of the psychological effects and implications of man's participation in sport and physical activity. Emphasis on psychological and learning theory, personality, and performance in physical activity.
- 345. **Group Influences in Sports.** I, 3 hr. PR: Research, Statistics, P.E. 320, 340. The content of this course is concentrated upon the manner and degree to which selected psychological processes of individuals are affected by involvement in sports.
- 360. **Bio-Mechanical Analysis of Sport and Physical Activity.** II, S. 3 hr. PR: Human Anatomy and Physiology, Physics, and Kinesiology. Advanced principles of body mechanics and analysis of muscle and joint actions in coordinated movement and neuromuscular physiology.
- 365. **Psychomotor Behavior Analysis.** II, S. 3 hr. PR: Doctoral standing. An in-depth study of psychomotor learning with emphasis on behavioral change in physical activity. Review of research and psychological thought pertinent to motor learning, personality, performance, and physical activity.
- 367. **Theories of Sport Physiology.** I, S. 3 hr. PR: Doctoral standing. A thorough and workable knowledge of principles involved in the interactions of muscles and nerves, reflexes, metabolism, cardiopulmonary function, environmental physiology, and the practical application of work physiology.
- 380. **History of Sport and Physical Activity.** II, S. 3 hr. PR: Graduate standing or consent. An anthropological and historical approach toward the influence of events, political and social climates, and personalities upon the sport cultures from early civilizations to the present.

425. **Educational Sport.** II. 3 hr. PR: Ed. 399, Stat. 211, P.E. 306, 465. This course treats the group dynamics of the sport situation for purposes of gaining insight into the techniques and methods of modifying social behavior through physical education sport activities.
445. **Program Planning I.** II, S. 3 hr. PR: Graduate standing or consent. An in-depth study of the manner in which the physical education environment is structured to elicit cognitive and psychomotor learnings, with an emphasis on program design, behavior modification, and evaluation processes.
446. **Program Planning II.** I, S. 3 hr. PR: Graduate standing or consent. An in-depth study of the manner in which the physical education environment is structured to elicit affective learnings. Emphasis on program design, social learnings, behavior modification, and evaluation procedures.
460. **Management Processes in Physical Education.** II. 3 hr. PR: Doctoral standing or consent. An analytical exploration of the situational, relational processes between the administrator of physical education school programs and the teacher of physical education, the physical education facility, and the physical education planned learning environment.
465. **Professional Physical Education Resource Seminar.** S. 3 hr. PR. Doctoral standing. This course is an introductory seminar for doctoral professional physical educators. Discussions and readings will center around current thought about physical education in its historical perspective.
480. **Dissertation Seminar.** I, II, S. 3 hr. PR: Advanced doctoral standing. This seminar is devoted to a critical analysis of the doctoral candidate's research proposal. Concentration will be on the statement of the problem, definitions of terms, research design, and methods of analyzing the data intended to be used in the candidate's research study.
497. **Research.** I, II, S. 1-15 hr.

Dance

400. **History and Philosophy of the Dance.** I, S. 3 hr. PR: P.E. 402 or equiv. A cultural survey of the dance as an expression of the society it represents; philosophy of the dance; the relation of the dance to other art forms; dance as an educational experience and the study of the works of the outstanding artists of today.
401. **Rhythms and Dance.** I, S. 3 hr. PR: Graduate standing and consent. Principles of movement, materials, and practicum in dance.
402. **Modern Dance Techniques and Composition.** I, S. 3 hr. PR: P.E. 35 and 36, graduate standing and consent. Application of scientific principles of movement; basic principles of music as related to dance movement; choreographic principles; practicum in dance movement. Principles for teaching the dance and problems involved in planning programs.
403. **American Folk Dance.** I, S. 3 hr. PR: P.E. 132 or equiv. Study of American square, contra, circle and round dances and play party games and their place in community and school recreation programs. Their relationships in the arts and other aspects of American culture. Analysis of techniques in leading and calling.

Safety

236. **Safety in Motor Transportation Services.** I, S. 3 hr. PR: Safety 300 and 310, or consent. Considers safety elements of automotive and other forms of transportation equipment, design, and control plus legislation and planning at federal, state, and local levels for improved safety features of transportation systems.
233. **Disaster Preparedness and Emergency Systems.** I, S. 3 hr. PR: Consent. Study of major elements involved in disasters and emergencies, preparedness planning, systems utilization, and attention to essential human services, with emphasis on community action.
251. **Driver and Highway Safety Fundamentals.** II, S. 3 hr. PR: Safety 131. Basic course for individuals who plan to teach courses to beginning drivers which emphasizes essential content, methods, and desirable practices for both classroom and laboratory applications.
254. **Teaching Driver and Highway Safety.** S. 3 hr. PR: Safety 251 or equiv. and valid driver license. Major aspects of teaching and coordinating driver and highway safety education including emphasis on curriculum construction, evaluation, marking, and administration. Arranged laboratory assures practice in providing behind-the-wheel instruction to beginning drivers.
255. **Current Safety Topics and Problems.** I, S. 3 hr. PR: Advanced graduate major in Safety or consent. Consideration of current and persistent problems in the field of safety in general and the component area of safety and traffic education. Seminar emphasis also extends attention to safety problems and issues of concern to participating class members.
300. **Philosophical Concepts in Safety.** I, S. 3 hr. Philosophies of the safety movement as expressed by leaders in the field are related to accident causation, accident prevention, and research implications. Emphasis is placed upon the relationships of environmental safety, safety services, and safety instruction to the major safety problems of modern living.
310. **Environmental Aspects of Hazard Control.** I, S. 3 hr. PR: Safety 300 or consent. An investigation of hazard control principles relating to environmental objects, facilities and equipment and control procedures recommended by authorities from the fields of engineering, medicine, and public health as well as from the field of safety.
311. **Human Factors in Accident Prevention.** II, S. 3 hr. PR: Safety 300 or consent. Investigation of concepts dealing with human behavior as related to accident experience in major reporting categories with consideration of psychological and sociological implications as well as motivational problems.
336. **Occupational Safety Program Management.** II, S. 3 hr. PR: Safety 300 or consent. Management guidelines, personnel techniques, and operational features applicable to safety programs designed for business, government, and industrial organizations.
337. **Personal and Environmental Safety Supervision.** II, S. 3 hr. PR: Safety 300 or consent. Supervisory methods, tools, and techniques designed to develop safety leadership qualities, to promote human relations, and to motivate employee responsibility for safe living practices.
351. **Safety Education Principles and Content.** II, S. 3 hr. PR: Consent. Study and analysis of content areas usually recommended for instructional programs within the field of safety, with emphasis on promotion of safe living practices.

356. **School and College Safety Administration.** II, S. 3 hr. PR: Graduate major in Safety or consent. Current emphasis in administering and supervising safety education, safety services, and environmental safety at various program levels from elementary school through college. Relationships between elements of various programs are stressed.
410. **Resource Seminar in Safety.** I. 3 hr. PR: Safety 300 and consent. Investigations, analyses, and discussions dealing with the varied sources of publications, material aids, consultant services, and other assistance available to safety professionals.
418. **Safety, Measurement, Evaluation, and Research.** II, S. 3 hr. PR: Safety 300. Analysis of evaluative data and statistical procedures applicable to the safety field plus investigation of nature and purposes of research dealing with safety and accident prevention with emphasis on human and environmental factors.
452. **Safety Manpower Development.** II. 3 hr. PR: Consent. Safety manpower positions, needs, and problems in relation to efforts of business, government, industry, and educational agencies to provide sufficiently effective professional and sub-professional preparation of safety practitioners.
454. **Safety Innovations and Problem Simulation.** S. 3 hr. PR: Safety 254 and 354 and teaching experience in driver education or consent. Advanced course which considers individual problems and emphasizes newer media plus unique adaptations as revealed by research and current literature in the field. Latest publications dealing with curriculum and supervision are examined.
457. **Planning and Coordinating Safety Programs.** I. 3 hr. PR: Advanced graduate standing in Safety or consent. Investigation of organizational structure, planning resources and techniques, and coordination functions involving safety programs in business, industry, government, and education.
459. **Safety Research Seminar.** II. 3 hr. PR: Advanced doctoral major in Safety and consent. Analysis of research designs and procedures for compilation, organization, treatment, and interpretation of data for safety research projects. (Required of all candidates for doctoral degrees in safety and traffic education).
472. **Practicum in Safety.** I. 3 hr. PR: Advanced doctoral major in Safety and consent. Individual and/or group experiences in development, implementation, and participation in special projects involving safety education, safety services, and environmental safety in schools, colleges, or communities. A minimum of 100 clock hours must be devoted to applied experiences.
497. **Research.** I, II, S. 1-15 hr.

School of Social Work

The graduate program in social work, accredited by the Council on Social Work Education, leads to the degree of Master of Social Work. It normally requires two academic years and one summer for completion.

Social work, one of the oldest human service professions, is based upon social and behavioral science information which is used to understand and provide the basis for helping individuals, groups, and communities. This knowledge is translated into the practice of the profession of social work. Social work practitioners help people with personal, economic, social, political, and inter-group problems.

The study of social work at the graduate level involves classroom and field studies. Students spend two semesters and one summer session in classroom study of subjects which are described below. In addition, the student spends two full semesters in block field instruction placements which are carefully selected to provide social work learning opportunities under the guidance of experienced professionals.

The WVU social work program concentrates on the preparation of people for leadership positions in rural and small communities, particularly those in the Appalachian region, of which West Virginia is a part. The Appalachian region offers unique opportunities to study and work with changing social environments. Parts of the region are redeveloping from worked-out farms and mines to new industrial areas. The region faces out-migration and immigration trends with all the personal adjustment and social organization problems such trends involve.

All field instruction of the WVU School of Social Work is provided in the Appalachian region, and much of the classroom content focuses on the region and on studies designed to help students understand it.

Graduates of the School of Social Work are employed throughout the United States and Canada. They work as individual and family caseworkers, as group treatment specialists, community organizers, social researchers, social work educators, and administrators in a variety of programs, such as mental health clinics, hospitals, correctional institutions, courts, delinquency programs, family counseling agencies, children's protective agencies, public welfare departments, public schools, community action agencies, settlement houses, city governments, state government planning agencies, federal administrative agencies, and private research and development organizations concerned with human problems.

Throughout the twentieth century there has been a constant growth in the need for professional social workers and it is anticipated by the Bureau of Labor Statistics and other research bodies that the demand for social workers will continue to increase both in terms of the numbers required and in terms of the varieties of programs in which social workers are employed.

The social work curriculum, in both the classroom and the field, is designed to help students prepare for these careers.

Curriculum

The five major instructional components in the Master of Social Work program are human behavior and the social environment, practice, social welfare policy and services, field instruction, and research.

The social worker is concerned with human behavior as it is manifested in the individual, in groups, and in communities. In order to understand these kinds of social phenomena, concepts from anthropology, sociology, psychology, and psychiatry have been selected for study. They are applied to an interpretation of conformity and deviance, including behavior such as over-compliance, neuroses, delinquency, mental illness, anomie, and alienation. Behavior is interpreted as the product of interaction between the individual and the social organizations and cultural norms to which he is exposed. Those concepts are selected from the social sciences.

The School of Social Work offers a program which emphasizes a comprehensive approach to social work practice. The student is helped to become a "specialized generalist" capable of understanding and actively engaging in a wide array of professional behaviors relevant to the range of social work responsibilities.

Throughout his first year in graduate studies, the student is taught a comprehensive approach to social work practice, providing him with the foundation principles, techniques, and values to practice social work with social systems of various sizes—from individuals to communities—as particular tasks require.

In the second year the student has an opportunity to develop specialized expertise to complement his generalist capacities by electing a concentration in either social work practice affecting individuals, families, and groups, or social work practice affecting organizations, institutions, and communities.

Emphasis throughout the social welfare policy and services courses is placed upon values, conflict of interest, professionalism, methodology, history, ideology, economics, and socio-legal-political change as they relate to policy formation, and the tasks, resources and roles of the social work professional. The courses deal with an analysis of the creation, institutionalization, and planning of social welfare policy and service in a democracy. Extensive consideration is given to selected social problems, such as poverty,

health, family planning, crime, housing, urban decay, the redistribution of political and economic power, the socio-economic problems of Appalachia, and planning the future, as they affect and are affected by policy formulation.

The research sequence prepares the social work student as a consumer of research information, having a bearing on solving problems the social worker confronts. Also, the student is prepared to participate in research as an investigator familiar with some of the technical and practical aspects of research design and activity. The student also is prepared to identify research problems and formulate research questions in social work.

Field instruction is an integral part of the social work program. It is the component through which the student is enabled to incorporate into his professional behavior the content learned in all areas of the curriculum. Primary consideration in making field instruction assignments is in the selection of field settings and locations which can fulfill the educational goals and objectives of the School and which can meet the particular educational needs of the student. In the selection of assignments, consideration is given to the student's area of interest, family situation, and stipend requirement.

In both the first and second year, students are assigned for field instruction during two alternating semesters. These field teaching and learning experiences are provided by field instructors who may be employed by the School of Social Work or who may be members of an agency staff. All field instructors work closely with faculty consultants.

The learning experiences provided are designed to assist the student in acquiring abilities for integrated practice and in developing the discipline and self-awareness essential to the professional social worker. Students are able to select from a wide range of innovative practice settings which utilize both traditional and non-traditional approaches. While in the field, students are expected to both provide services to people and to learn from their involvement with human problems. Examples of the non-traditional approaches available include the linkage between graduate and undergraduate field instruction units and the evaluation and initiation of new manpower utilization programs.

A recent innovation in the field instruction program has been the opportunity for overseas placements. Students have been assigned primarily in Wales, United Kingdom, with the collaboration of the University College of Swansea. As an experiment, some students also were sent to East Africa in 1970.

The 1972-73 field instruction placements and their instructors are:

Allegheny County Board of Assistance, Pittsburgh, Pa., Shirley LeBlanc.

Allegheny County Chapter of the Pennsylvania Association for Retarded Children, Wayne Hanson.

Appalachian Mental Health Center, Elkins, W. Va., Paul Enoch.

Appalachian Regional Hospital, Beckley, W. Va., Mel Henry and John Johnson.

Appalachian Regional Hospital, Williamson, W. Va., Charles Glover.

Catholic Social Service of Allegheny County, Pittsburgh, Pa., Jane Bradley.

Central District Guidance Centers, Clarksburg, W. Va., James Chapman and Geraldine Salisbury.

Chartiers Mental Health and Mental Retardation Center, Bridgeville, Pa., Gerald Vest and Richard Ney.

Children and Family Service Association, Wheeling, W. Va., Palmer Ulman.

Child Development Unit of West Virginia, Morgantown, W. Va., Phyllis Elliott.

Community Council of Kanawha Valley, Inc., Charleston, W. Va., James Pierce.

Community Services of Pennsylvania, Harrisburg, Pa., Richard Bachman.

Court of Common Pleas of Beaver County, Juvenile Probation Dept., Beaver, Pa., Rolf W. Lotz.

Comprehensive Mental Health Center, Meadville, Pa., John Radkowski.

Designs for Rural Action, Charleston, W. Va., Marjorie Buckholz.

Division of Vocational Rehabilitation, W. Va. Rehabilitation Center, Institute, W. Va., Elizabeth Minton.

Fairmont Clinic, Fairmont, W. Va., Karen Harper.

Family Service Association, Huntington, W. Va., James Coen.

Family Counseling-Travelers Aid of The Kanawha Valley, Charleston, W. Va., Virginia B. Myers.

Fayette County Association for Retarded Children, Uniontown, Pa., G. Richard Sell.

Family Service Association, Morgantown, W. Va., Patricia Keith and Florence Porter.

Federal Reformatory for Women, Alderson, W. Va., Virginia Wilson.

Hancock-Brooke Mental Health Services, Weirton, W. Va., David O. Miller.

Health and Welfare Association of Allegheny County, Pittsburgh, Pa., Marshall Gordon.

Human Services to Aging Persons in Rural Areas, Grafton, W. Va., Margaret Emery.

Information and Volunteer Services of Allegheny County, Pittsburgh, Pa., Aaron Sacks.

Intermediate Court of Kanawha County, Charleston, W. Va., Eloise Crim.

Jefferson County Guidance Center and Mental Health Clinic, Steubenville, Ohio, John R. Klenowski.

Job Corps Center for Women, Charleston, W. Va., Carol Glasser.

Lakin State Hospital, Lakin, W. Va., Julius McCloud.

Monongalia County Health Department, Morgantown, W. Va., Marjorie Buckholz.

Monongalia County Health Department, Special M&I Project, Morgantown, W. Va., Antoinette H. Arkle.

Monongalia County School System, Morgantown, W. Va., Helen Ellison.

Mon Valley United Health Services, Monessen, Pa., Joseph DeOto and Joseph Havrilla.

Need Council, Morgantown, W. Va., Josephine Stewart.

The New Life, Inc., Steubenville, Ohio, John Klenowski.

Office of the City Manager, Morgantown, W. Va., Marjorie Buckholz.

Pennsylvania Board of Probation and Parole, Pittsburgh District Office, Pittsburgh, Pa., Fred Jacobs.

Ridgway Area Psychiatric Center, Ridgway, Pa., John Yates.

Robert F. Kennedy Youth Center, Morgantown, W. Va., Don Magel.

Rock Forge Settlement, Sabraton, W. Va., Marjorie Buckholz.

Rural Manpower Research and Training Project, Morgantown, W. Va., Margaret Emery and John Miller.

Scott's Run Settlement House, Osage, W. Va., Marjorie Buckholz.

Social Work Unit, Department of Behavioral Medicine and Psychiatry, University Hospital, West Virginia University, Morgantown, W. Va., Janice Cone and Patricia Porterfield.

South Hills YMCA, Pittsburgh, Pa., Gerald Vest.

Student Counseling and Psychological Services Center, West Virginia University, William Green.

Tri-Capp, Charleston, W. Va., Dorothy Halstead.

Undergraduate Social Work Education, Morgantown, W. Va., Betty Baer, Jon Hunter, and Leon Williams.

United Mine Workers of America, Health and Welfare Area Medical Office, Morgantown, W. Va., Betty Veach.

United Way of Beaver County, New Brighton, Pa., William Stamaton.

Valley Counseling Center, Morgantown, W. Va., Wayne McDevitt and Josephine Stewart.

Veterans Administration Hospital, Clarksburg, W. Va., Carl Benedum.

Veterans Administration Hospital, Chillicothe, Ohio, Arlen Miller and Nicholas Kempf.

Veterans Administration Hospital, Huntington, W. Va., Eric Cutlipp and Robert Ewing.

Veterans Administration Hospital, Leech Farm Road, Pittsburgh, Pa., Alma Burgess.

West Virginia Human Resources Association, Fairmont, W. Va., Walter Case and Beatrice Hunter.

Youth Development Center, Loysville, Pa., John R. Williams and Joseph Anderson.

Youth Development Center, Waynesburg, Pa., Gloria Gugliotta and Ruth Pincus.

Admission to the Graduate Program

Requirements

Students are admitted for graduate study in the School of Social Work who meet all of the following requirements:

1. Graduation with a bachelor's degree from any accredited college or university.

2. Proof of academic achievement. Graduate school regulations require an undergraduate grade-point average of at least 2.5 for approval of candidates as *regular* graduate students. An undergraduate grade-point average of 2.25 is required of all candidates for approval as *probationary* graduate students.

3. Evidence of potential to practice social work, such as commitment to human service, and concern about and ability to work effectively with people.

Admission With Advanced Standing

Students may request up to one year's advanced standing if they meet the regular requirements of the Graduate School and of the School of Social Work. In addition, applicants must:

1. Have received a baccalaureate degree in social work or social welfare awarded by an accredited college or university which is a constituent member of the Council on Social Work Education.

2. Have a highly ranked academic background (approximately a 3.0 cumulative grade-point average on a 4.0 scale.)

Request for advanced standing must be made at the time of application and approved by the Admissions Committee. Applicants who are granted one year of advanced standing will register to begin with the summer session and must complete that session plus no less than two additional semesters of graduate level work. Disapproval of requests for advanced standing will not prohibit acceptance into the regular, full two-year program.

Part-Time Program

Applicants may elect to extend their graduate program up to a maximum of four years by specifically requesting part-time status in their application for admission. To be accepted, the student must meet the usual University and School of Social Work entry requirements, have a definite objective of completing the master's program within a four-year period, and present an acceptable plan for completing requirements.

Financial Aids

The School of Social Work has a limited number of scholarships, traineeships, and educational stipends which are available for full-time graduate social work students who meet the qualifications.

Federal traineeships from the National Institute of Mental Health, Children's Bureau, and the Rehabilitation Services Administration, cover tuition, living expenses, and dependency allowances. Veterans Administration traineeships provide stipends for students who have field placements in Veterans Administration institutions. Board of Regents scholarships entitle students to remission of all fees except student activity and field instruction fees.

Application for and information on financial aid from these sources should be made to the Chairman of Admissions at the time of application for admission. Information concerning other public and private financial aids may be obtained from the Chairman of Admissions.

Recommended Application Date

Applicants are urged to complete their applications before March 1st, in order to guarantee their consideration for admission and for school administered financial aids. First-year students are admitted only in the fall of each academic year. Students admitted to the program with second-year status enter in the summer session.

Requirements for the Degree of Master of Social Work

The degree of Master of Social Work is conferred by the University upon those students who satisfactorily complete the requirements as established by the Graduate School. These requirements are:

1. Completion of graduate courses approved by the School of Social Work totaling not fewer than 61 semester hours. This means completion of the required courses including electives (or approved substitutions from other divisions of the University). Thus, most students will be required to complete a total of 68 hours in order to have both required and recommended courses (see detailed listing of the required graduate Social Work Program).

2. Students may request credit for up to 6 hours earned in graduate study in approved courses taken in other divisions of WVU; through graduate social work extension courses or approved courses from other accredited universities. Such requests *must* be made at the time of application for admission and approved at that time, for students to be able to claim such credit toward the requirements for the M.S.W. degree.

3. Satisfactory completion of all components of the graduate program.

4. A cumulative average of at least 2.75 for the total graduate program.

Required Graduate Social Work Program, 1972-1974

First Year, 1972-1973

Fall Semester	Credit
S.W. 321— Human Behavior and the Social Environment I.....	4
S.W. 331— Social Welfare Policy and Services I.....	4
S.W. 340— Introduction to Social Work Practice	5
S.W. 497— Research I (Principles and Theory).....	3
	15

Spring Semester

S.W. 381— Field Instruction.....	5-14
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Second Year, 1973-1974

Summer Session

S.W. 322— Human Behavior and the Social Environment II.....	2
S.W. 332— Social Welfare Policy and Services II.....	2
S.W. 341— Practice Affecting Individuals, Families, and Small Groups...	2
S.W. 351— Practice Affecting Organizations, Institutions, and Communities.....	2
S.W. 497— Research II (Methods and Design)	3
	11

Fall Semester

S.W. 481— Advanced Field Instruction.....	5-14
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Spring Semester

The following are the recommended courses for the spring semester. Within the recommended courses, all students are allowed to take one elective. One practice course (either S.W. 441 or S.W. 451) is required and the research course is required. Students, with the approval of their advisers, may choose to take other electives, within or outside of the School. It is conceivable that one could also take both S.W. 441 and S.W. 451 under such a plan, if desired.

S.W. 421— Human Behavior and the Social Environment III	2
S.W. 431— Social Welfare Policy and Services III.....	2
S.W. 441— Advanced Practice Affecting Individuals, Families and Small Groups.....	3
or	
S.W. 451— Advanced Practice Affecting Organizations, Institutions and Communities	3
S.W. 460— Social Work Management	3
S.W. 380— Special Topics (Elective).....	2-3
or	
S.W. 480— Seminar (Elective).....	2-3
S.W. 497— Research III (Research project or advanced course)	2
	14-15

Courses of Instruction

General prerequisites. A concentration of courses in the social sciences is highly desirable for entrance into social work education because this knowledge is reviewed and applied to the practice of social work. Students lacking this background are expected to compensate for it by independent study.

With the exception of S.W. 200, 210, and 220, enrollment in graduate social work courses is designed for students admitted to the graduate program.

Some graduate students in other programs, after consultation with their advisers and subsequent approval by the School of Social Work, may want to work out minors in social work or take certain graduate social work courses.

Social Work

S.W.

321. **Human Behavior and the Social Environment I.** 4 hr. Human behavior is interpreted as the product of interaction between the individual and the social organizations and cultural norms to which he is exposed. The effects upon the individual and his family of deprivation caused by poverty and social exclusion are studied. Selected theoretical approaches to personality, small groups, organizations and communities are studied. Implications for intervention at each system level and the interaction between system levels are considered.
322. **Human Behavior and the Social Environment II.** 2 hr. In this course the objective is to increase understanding of organizations, communities, and small groups as they develop, change, and affect behavior of those affiliated with them.
331. **Social Welfare Policy and Services I.** 3 hr. A critical analysis of the historical rise of social welfare policy in the western world plus the rise of the social work profession. An introductory understanding of the dynamics of policy formulation and social planning with particular reference to income maintenance.
332. **Social Welfare Policy and Services II.** 2 hr. A critical appraisal of the policies and underlying the delivery of social services in various settings and fields of practice, both public and voluntary, with emphasis upon the need for new services.
340. **Introduction to Social Work Practice.** 5 hr. Introduction to basic concepts, principles, values and skills intrinsic to all social work practice with an emphasis on the range of social tasks and the nature and purposes of social work intervention.
341. **Practice Affecting Individuals, Families, and Small Groups.** 2 hr. Social Work Practice "A". This course builds on S.W. 340 by elaborating and differentiating specific processes which have the primary goal of aiding in restoring, maintaining, or enhancing the social functioning of individuals, families, and small groups through various social systems. The content, while reflecting the utilization and integration of inputs from the total curriculum of the present, is especially geared toward the focus of changing practice—practice as ever adapting to changing knowledge base and social environment.
351. **Practice Affecting Organizations, Institutions, and Communities.** 2 hr. Social Work Practice "B". This course provides students with opportunities to develop competence in:
 - a. analyzing community and neighborhood problems.

- b. **facilitating** the efforts of citizen associations to bring about social change
- c. **planning** effective programs and approaches for meeting human needs.
- d. **influencing** the behavior of other systems, particularly organizations, in desired directions.

Students develop capabilities for carrying out **professional roles** aimed at enhancing the functioning of social systems, neighborhood, community (rural and urban), and organizational, through the study of social theory, and laboratory experiences.

- 375. **Individual Consultation.** 1-3 hr. PR: Consent. Individual directed study to develop extensive knowledge in a social work area of student interest.
- 380. **Special Topics.** 1-6 hr. Examinations of selected issues in social work and social welfare. In the past topics have included issues in public welfare policy, social work practice implications related to the contemporary racial crisis, social welfare in developing countries, citizen participation in social planning and change, use of groups in staff development, etc.
- 381. **Field Instruction I.** 5-14 hr. Field Instruction and practice in selected settings under general direction of the faculty.
- 421. **Human Behavior and the Social Environment III.** 2 hr. An intensification of the understanding of behavior of individuals and of societies by the student is achieved through an intensive review of selected theoretical material that has been covered in courses S.W. 321 and S.W. 322. The knowledge is applied to experiences the student has had in his field work. Effort is made to achieve an integration with knowledge from other courses in order to appreciate the interrelationship of behavior of individuals, societal groups, and communities. Capable students may select projects which will help them extend their knowledge and its application upon which they work independently.
- 431. **Social Welfare Policy and Services III.** 2 hr. Emphasis is placed upon the student's ability and skill in formulating policy procedure, social planning and social action, in relation to certain major social problems and issues as a change agent. Social problems are developed from the perspective of the student's interests and concerns.
- 441. **Advanced Practice Affecting Individuals, Families, and Small Groups.** 3 hr. A seminar in advanced practice to enhance expertise in that area of practice begun in S.W. 341. This course will integrate field experience as well as content of S.W. 351.
- 451. **Advanced Practice Affecting Organizations, Institutions, and Communities.** 3 hr. In this course a student may select one or more seminars covering specific aspects of social planning and organizing. They will include advanced study in change at state and federal levels, including legislative process, the volunteer in social planning, planning structures and citizen involvement, organizing skills for social action.
- 460. **Social Work Management.** 3 hr. An intensive examination of the concepts, principles and skills of administration, consultation, supervision, and teaching in social work practice.
- 480. **Seminar.** 1-6 hr. Intensive study in the student's area of special interest. In the past topics have included those listed under S.W. 380 as well as study of indigenous groups, human sexuality and social work, issues and trends in social work, etc.
- 381. **Advanced Field Instruction II.** 5-14 hr.

497. **Social Work Methods I.** 1-15 hr. This course is the first half of a two semester introduction to basic concepts in social research methods and statistics. Classroom lectures are alternated with weekly laboratory sessions. Emphasis is placed on conceptualization of social work problems for research, role of social science theories in research, operationalization of concepts, options in research design, and elementary statistics.
497. **Social Research Methods II.** 1-15 hr. This course, a continuation of Social Research Methods I, emphasizes the more technical aspects of research design, problems of measurement, statistical analysis of data, and computer usage. Students electing to conduct a piece of research in their second year, in lieu of taking Social Research Methods III in the final semester, design a research project and submit a proposal by end of term.
497. **Social Research Methods III.** 1-15 hr. This final course, for those not electing to do a research project in the second year, emphasizes the application of research concepts to varying modes of social work practice. Individual or small group projects are adapted to student interest and professional career choice. Students not taking this course (i.e., those who conduct a research project during the second year) must submit a written research report by April 15.

Courses on the 200 level are open to advanced undergraduate and graduate students in other programs. They do not provide credit toward the M.S.W.

S.W.

200. **Social Welfare Policy and Services.** 3 hr. PR: S.W. 51 or consent. An introduction to the institution of American social welfare. The content of the course is intended to contribute to the student's knowledge of the history, philosophy, objectives, and organization of social welfare policies and services in the United States. This course will remain as is except for a change in title (formerly called Introduction to Social Welfare). A laboratory experience will be included as part of the course content to provide opportunity for students to study and observe selected social welfare institutions.
210. **Social Welfare Policy and Services in Appalachia.** 3 hr. PR: S.W. 200 or consent. The content of this course will focus on the way in which social welfare services are organized in the state and region and provide opportunity for students to become involved in the analysis of social, cultural, economic, political factors which influence the system of social welfare policies and services in the Appalachian Region. Knowledgeable persons from throughout the University and state will be invited to participate in selected lectures and a laboratory experience will be utilized to involve students in processes of problem-solving around selected social welfare policy issues.
220. **Social Work Methods I.** 3 hr. PR: S.W. 200 or consent. This course will focus on theories and concepts of intervention including prevention and rehabilitation, with individuals, families, groups, and communities. Through classroom and laboratory experience, students will be helped to examine illustrative problem areas, such as mental illness, alcoholism, poverty, delinquency, etc., and select what might be the appropriate helping approaches. In addition, emphasis will be placed on students learning beginning skills in interviewing, observation, recording, problem identification and analysis, and community study.

221. **Field Experience in Social Work.** 3 hr. PR: S.W. 220. Through a supervised field experience in a community agency or program students have the opportunity to further develop some of the basic helping skills. Students spend a minimum of four hours weekly in the supervised field experience. In addition, all students in field experience will meet in a weekly seminar with a faculty instructor.
222. **Social Work Methods II.** 3 hr. PR: S.W. 221. All areas of student learning will be utilized to help students examine and analyze the variety of approaches to intervention, prevention, and rehabilitation as used in current programs, such as community action, model cities, Comprehensive Community Mental Health Center programs, organized population groups, services of Departments of Public Welfare, and the Extension programs. Field trips will be utilized to provide students an opportunity to observe and experience a selected number of the multiplicity of approaches which are currently utilized in all communities.
280. **Seminar.** 1-6 hr. An elective for those majors who, on the senior level, demonstrate capacity for independent study and research. Students who are approved for participation in the seminar will be expected to select a topic for study and research from a range of current issues in social work. The weekly seminar will be used for student presentations and for discussion, analysis and critique of students' work.

Continuing Education Courses

The School of Social Work provides a series of 300-level courses which are designed for professionals employed in health, education and welfare agencies and services. Such courses are given both on campus and in extension.

300. **Public Welfare.** 3 hr. An introductory course which examines the broad range of social welfare services, both public and private with a critical analysis of the development of health and welfare programs alongside of contemporary problems and issues. The course is of interest to those who regularly work with individuals and families that make use of, or rely upon welfare services, such as teachers, social caseworkers, counselors, and public health nurses.
305. **Child Welfare.** 3 hr. Childcare in the 1970's. Focus is on changing nature and function of the family; alternatives to traditional family care in meeting the needs of children will be considered. Services to children such as the public school, the alternative school, day care, public welfare and family assistance plans as they support and supplement family care will be considered along with services to meet special problems. This course is intended for school teachers, public health nurses, social workers, school attendance workers, and others working with children and their families.
307. **Introduction to Social Casework I.** 3 hr. Basic principles of casework as a process of social interaction and intervention with problem-solving as an inherent goal. Special attention is given towards increasing skills in interviewing, observation, assessment of problems and in setting appropriate and constructive goals. The course is of interest to those who are working in the fields of mental illness, alcoholism, poverty, health, remedial education, and rehabilitation.
308. **Introduction to Social Casework II.** 3 hr. PR: S.W. 307 or equiv. Utilization of basic casework method as a foundation for development of skills in providing services to groups of individuals, families and community.

Theories and concepts of intervention, prevention and rehabilitation within the broad range of skill and knowledge requirements for contemporary practice in health, education and welfare services. Of interest to those who work with small groups of children or adults.

310. **Introduction to Human Behavior I.** 3 hr. Study of behavior as basically learned responses acquired from social situations and experiences. Individual and group behavioral norms from varying and diverse socio-cultural environments are examined within the framework of common social institutions—the family, neighborhood and social mobility groups, schools, vocational settings, etc. Of interest to social workers, employment counselors, teachers, rehabilitation, poverty, and community mental health workers.
311. **Introduction to Human Behavior II.** 3 hr. PR: S.W. 310 or equiv. Further study of psycho-social and cultural determinants designed to increase knowledge and understanding of individual and group behavior through an analysis of social organizations with a special focus on the impact of deprivation from various sources and causes. Students are encouraged to apply their knowledge from this and other courses to their current work. Independent or group projects are encouraged. Of interest to social workers, employment counselors, teachers, rehabilitation, poverty, and community mental health workers.

INTERDEPARTMENTAL PROGRAMS

Life Sciences

Genetics and Developmental Biology: Dr. Randall W. Reyer, 4013 Basic Sciences Building.

Research Areas—Biochemical genetics, developmental genetics, cytogenetics, quantitative genetics, human genetics, forest genetics, molecular aspects of development, experimental morphogenesis, teratology, regeneration, oncology, descriptive embryology, life cycles of animals and plants and host-parasite relationships.

Plant Physiology: Dr. Morris Ingle, 2072 Agricultural Sciences Building.

Research Areas—Plant soil water relations; environmental physiology; micrometeorology; physiological effects of air and water pollution; tissue culture; cytokinins; auxins; morphogenesis; physiology and biochemistry of plant growth; physiology of cold hardness; post-harvest physiology; organic acid metabolism; polyphenol metabolism; physiology of chilling injury, role of boron and other micro-elements; herbicide physiology; fruit physiology.

Reproductive Physiology: Dr. E. K. Inskeep, G016 Agricultural Sciences Building.

Research Areas—Physiology of spermatozoa; fertility and viability of aged ova; regulation of the life span and function of the corpus luteum; effects of light and other environmental factors on reproduction; physiology of uterine contractions; dietary mineral levels and reproduction; endocrinology and metabolism; role of gonadotropic hormones in control of steroidogenesis; control of estrus and ovulation and use of artificial insemination in beef cattle, swine and sheep; and physiology of intrauterine contraceptive devices. The members of the Faculty of Reproductive Physiology and their research facilities are located in various departments: Anatomy; Animal Science; Biology; Genetics; Internal Medicine; and Obstetrics and Gynecology.

Rigid statements concerning academic requirements for graduate studies in the biological sciences cannot be made. The faculty of each program sets its own requirements, details of which may be obtained from the appropriate chairman of the department or faculty. In general, students with good academic records with majors in the agricultural and medical sciences and in chemistry, physics and mathematics are desirable applicants. All students should be adequately prepared in mathematics, biology, and chem-

istry, especially the latter. Potential graduate students are urged to take both the aptitude and advanced tests of the Graduate Record Examination during their senior year as undergraduates. It is advisable to prepare for the foreign language requirements for the Ph.D. degree by taking undergraduate courses in French or German.

A general application form may be obtained from the Dean of the Graduate School. Inquiries concerning individual programs, financial assistance, departmental requirements, and professional career opportunities should be sent to the appropriate departmental chairman as listed.

Botanical and Zoological Sciences

Biology: Dr. E. C. Keller, Jr., 200 Brooks Hall.

Research Areas—Molecular biology: methyl transferase function, control of betacarotene synthesis, mechanisms of steroid actions in phycomycetes, biochemistry of plant hormones. Cellular biology: nuclear function and plant morphogenesis, the physiology and biochemistry of avian and mammalian germ cell, synchronized cell division, cytology, endocrine systems in reproduction. Organistic biology: plant physiology, plant and animal morphology, vertebrate morphogenesis, animal behavior, systematic and taxonomic studies of animal life of the Appalachian region, chemotaxonomy. Population biology: ecological systems and environmental stress, especially air and water pollutants, ecology of algae, fisheries biology, productivity of streams and reservoirs, vertebrate ecology and speciation, plant speciation, ecological taxonomy.

Agricultural Sciences

Faculty of Agricultural Biochemistry: Dr. David A. Stelzig, Chairman, 1046 Agricultural Sciences Building.

Research Areas: Enzymes, carbohydrates, lipids, proteins, nutritional biochemistry, plant biochemistry, and biochemical genetics.

Plant Sciences Division: Dr. Mannon Gallegly, Director, 1090 Agricultural Sciences Building.

Agronomy: Field crop, forage and pasture production and management; crop rotation systems; cutting management, stand establishment and longevity of forages; weed control; low temperature hardiness, physiological effects of chemicals on crop plants and weeds.

Entomology: The M.S. degree is offered in this division and the Ph.D. degree for entomology students is available through the Genetics-Developmental Biology program.

Genetics: Biochemical genetics of enzyme polymorphism; physiological-biochemical basis of heterosis; molecular basis of develop-

ment and differentiation; cytogenetic, cytotaxonomic and cytological studies in plants.

Horticulture: The division offers an M.S. degree in various aspects of horticulture. Students wishing to continue their work toward the Ph.D. degree usually do so in the Plant Physiology program.

Plant Pathology and Bacteriology: Agricultural Bacteriology—microbiology of streams and ponds; microbial decomposition in sanitary landfills; physiology of fungi; effects of light on fungi; mycoparasitism. Plant Pathology—physiology of host-parasite relationships; late blight of potato and tomato; disease of field and forage crops; biology and control of plant parasitic nematodes; oak wilt; decay of hardwoods and wood products.

Soil Sciences: Soil chemical properties and their interrelationships, characterization of soil phosphorus and organic nitrogen compounds; nutrient availability as related to soil structure, time and rate of potassium fertilization on crops; hydrology of watersheds on shale soils, factors relating to frost heaving, surface mine land reclamation; micronutrient availability; soil fertility; forest-soils relationships.

Division of Animal and Veterinary Sciences: Dr. Alfred L. Barr, Director, G-036 Agricultural Sciences Building.

Research Areas—Nutrition: Control of feed intake; nonprotein nitrogen metabolism; bacterial carbohydrate metabolism in ruminants. Physiology: Magnesium homeostasis; pituitary-ovarian relationships; dietary factors and thyroid function; breeding seasons and reproductive efficiency. Veterinary Pathology: Avian infectious synovitis; pathogenesis of uterine infection. Genetics and Breeding: Genetic and environmental factors in production of meat, milk and eggs; genetic effects of irradiation; evaluation of breeding systems.

Division of Forestry: Dr. David E. White, Director, 322-A Forestry Building.

Students may major in forest ecology, forest economics, forest genetics, forest hydrology, forest management, forest mensuration, forest protection, silviculture, or wood industries.

Medical Sciences

Anatomy: Dr. Donald L. Kimmel, 4053 Basic Sciences Building.

Research Areas—Gross Anatomy: Anatomical variations and anomalies, and electromyographic studies of specific muscle groups. Microscopic Anatomy: Studies of cells, tissues and organs, under normal and experimental conditions with histochemical, electron microscopic, autoradiographic, regenerative, and fluorescent techniques. Developmental Anatomy: Experimental and descriptive embryology, cellular differentiation, and dedifferentiation, organizers and the effects of different environments on develop-

ment. Neuroanatomy: Experimental, comparative and embryological studies of specific nerve cell groups and nerve pathways in the spinal cord, brain stem, cerebellum and cerebrum.

Biochemistry: Dr. Reginald F. Krause, 3127 Basic Sciences Building.

Research Areas—Nutrition: Vitamin A and carotene metabolism. Enzymology: enzyme kinetics. Biological Transport: fatty acids and amino acids. Organic synthesis of biological compound: "sulfones." Immuno Chemistry: compliment factors; antigen-antibody reactions. Genetics: biochemical defects in inherited diseases. Lipid Metabolism: arthrosclerotic disease and cardiac hypertrophy. DNA and RNA metabolism in cancer cells.

Microbiology: Dr. John M. Slack, 2078 Basic Sciences Building.

Research Areas—Immunology: Studies on the mechanisms of antigen-antibody reactions and the development of hypersensitivity. Virology: Characterization of respiratory viruses using tissue cultures and fluorescent antibody techniques. Parasitology: Host-parasite relationships between various protozoa and insects on animal hosts. Physiology: Nutrition and metabolism of a variety of pathogenic microorganisms. Genetics: Basic studies on the mechanisms of genetics including transformation of genetic information. Electron Microscopy: Cytological studies of the fine structures of microorganisms and the influence of environment on these structures.

Pharmacology: Dr. William W. Fleming, 3152 Basic Sciences Building.

Research Areas—Autonomic Pharmacology: autonomic regulation of the cardiovascular system and of smooth muscle; sensitivity to autonomic drugs; synthesis, release and metabolism of catecholamines; cholinesterase inhibitors. Chemotherapy: antimalarial agents, effects of chemotherapeutic agents on intestinal flora and fauna. Biochemical Pharmacology: drug metabolism; effects of drugs on lipid and nucleic acid metabolism. Endocrine Pharmacology: mechanism of action of steroids; metabolism of sexaccessory tissues. Neuropharmacology: mechanism of action of anticonvulsants; neuromediators in the central nervous system. Toxicology: metabolism of toxic agents; tolerance to organophosphorus compounds.

Physiology and Biophysics: Dr. M. F. Wilson, 3055 Basic Sciences Building.

Research Areas—Cellular, membrane transport and electrical properties of excitable tissue; integrative and behavioral functions of the nervous system; regulation and dynamics of the circulation, respiration, endocrine, and electrolyte balance systems; theoretical and experimental biophysics; and biomedical instrumentation.

Committee on African Studies

Since 1961, West Virginia University has served as an AID Contractor responsible for agricultural education in East Africa. With one exception, the contracts have been directed toward agricultural education below the degree or professional level. To support the objectives of these contracts, WVU has employed expert staff from its colleges, divisions, and off-campus programs, under the direction of the University Office of International Programs. Fifty-eight University employees have served one or more two-year appointments in Africa.

Further, WVU has followed the practice of employing experts required in supporting roles not directly related to the active phase of its contractual commitments, in teaching and research positions on its home campus.

Since the early part of 1967, the University has expanded its technical and academic competence regarding Africa from solely the agricultural sciences to include the social sciences and humanities. Presently, several units of the Colleges of Arts and Sciences, Business and Economics, Creative Arts, and Human Resources and Education are actively engaged in the teaching and research of African and Africa-related subjects. New faculty are regularly added to complement African studies, and the University is sponsoring serious African research and curriculum development within the arts, sciences and humanities as well as within agriculture. Special educational programs in African studies are beginning to proliferate on both the Evansdale and Downtown campuses.

West Virginia University has gained experience in developing a rapport with foreign students—African and others. Over seventy-five students from Africa have earned certificates, diplomas, and degrees in formal subject areas at the University; and increasing numbers are enrolling every year. More than two hundred short-term participants have engaged in studies and other activities at the University.

The Committee on African Studies was formally organized in 1969 to fulfill two basic requirements: (1) to blend the agricultural expertise of longstanding with the newer programs of study and research into a unified whole of course offerings and systematic research; and (2) to make available the knowledge present in the social sciences and arts concerning Africa to existing and prospective University programs of African technical assistance.

Moreover, it is within the Committee's mandate to broaden its activities to include other parts of the world experiencing problems of development and human change similar to those of Africa. Although the University's assistance, instructional and research programs, now relate primarily to East Africa, they do have a wider application. The concepts and philosophy developed in all of these activities have utility throughout Africa and, with suitable modification, should be of benefit to other developing areas of the world, including the Appalachian Region.

Academic Goals of the Committee

Instructional Goals

In their broadest immediate sense, the instructional goals of the Committee are: (1) to provide for WVU an interdisciplinary competence in the teaching of the complex human and technological aspects of African development; and (2) to secure and maintain the procedural means for students in many fields readily to avail themselves of these interdisciplinary African and development studies.

Research Goals

The research goals of the Committee are: (1) to provide interdisciplinary means through which significant contributions to the advancement of knowledge in African and development studies can be made by University faculty; and (2) to provide the opportunity for undergraduate and graduate students to pursue investigations, including field research, which will benefit greatly their learning experiences at WVU.

The Africana Library Collection

For several years, the University Library has accumulated African materials in a variety of disciplines; so that presently the Africana collection contains nearly 6,000 volumes, exclusive of periodicals, and is capable of supporting undergraduate and graduate research up to and including the doctoral level within several natural and social sciences.

Academic Programs of the Committee

Degree Programs

The Committee does not offer either undergraduate or graduate degrees in African studies as such; but rather stimulates the interdisciplinary study of Africa and development on the part of students who are formally associated with departments in the natural and social sciences and humanities.

In the fall of 1970, the University's Public Administration Program was expanded to include an option in development administration. In effect, the offering of this option allies the Committee on African Studies and its curriculum with the Public Administration Program. Graduates completing the option are awarded the Master of Public Administration degree, with an interdisciplinary concentration in the area of African and development studies.

Special Academic Programs and International Study

The Committee provides opportunities for special non-degree study in Africa-related subjects at the University, as currently sponsored by the Office of International Programs; and is working to develop international study programs within Africa for University faculty and students.

African Speakers Program

For five years, the University has sponsored speakers on Africa to come and speak before University audiences. This program will be continued and expanded by the Committee on African Studies.

Research and Fellowship Programs

At present, the University, through the Office of International Programs, is sponsoring field research projects in East Africa, for faculty within the natural and social sciences and humanities. It is the intention of the Committee to enlarge these opportunities and especially to provide interdisciplinary facilities for student field research at the graduate level.

Further information concerning the Committee and its program can be obtained from:

Newton M. Baughman
Office of International Programs
2112 Agricultural Sciences Building

Rodger Yeager
Department of Political Science
207 Woodburn Hall

African and Related Graduate Courses of Study

College of Agriculture and Forestry

Division of Animal and Veterinary Sciences

AI&VS 420—Special Topics.

VS 497—Research.

Faculty of Agricultural Biochemistry

Agr. Biochem. 320—Special Topics.

Agr. Biochem. 497—Research.

Division of Forestry

Forest Management 470—Special Topics.
Forest Management 497—Research.

Division of Plant Sciences

Agron. 420—Special Topics.
Agron. 497—Research.
Genet. 420—Special Topics.
Genet. 497—Research.
Hort. 420—Special Topics.
Hort. 497—Research.
Plant Path. 420—Special Topics.
Plant Path. 497—Research.

Division of Resource Management

Agr. Econ. 213—Economic Development.
Agr. Econ. 420—Special Topics.
Agr. Econ. 497—Research.
Agr. Educ. 320—Special Topics.
Agr. Educ. 497—Research.
Agr. Mech. 420—Special Topics.
Agr. Mech. 497—Research.

College of Arts and Sciences

Department of English

Engl. 286—Black American Fiction

Department of Geology and Geography

Geogr. 246—Geography of Africa.

Department of History

Hist. 229—History of Africa: Pre-Colonial Africa.
Hist. 230—History of Africa: European Dominance and Independence.
Hist. 251—History of Black People in America to 1900.
Hist. 252—History of Black People in America Since 1900.
Hist. 425, 426—Readings, Seminar in African History.

Department of Political Science

Pol. Sci. 258—Politics of Africa.
Pol. Sci. 290—Socio-Politics of Africa.
Pol. Sci. 295—Politics of Planned Development.
Pol. Sci. 391—Leadership and Authority in Africa.
Pol. Sci. 394—Theory of Political Development.
Pol. Sci. 440, 441—Directed Readings and Research in Public Administration.
Pol. Sci. 449—Seminar in Public Administration.
Pol. Sci. 450, 451—Directed Readings and Research in Comparative Government.
Pol. Sci. 459—Seminar in Comparative Government.
Pol. Sci. 460, 461—Directed Readings and Research in International Relations.

Department of Sociology

- Sociol. 205—Social Stratification.
- Sociol. 223—Sociology of Rural Life.
- Sociol. 240—Social Change.
- Sociol. 241—Population and Migrations.
- Sociol. 251—Cultural Dynamics.
- Sociol. 253—Cross-Cultural Studies in Development.
- Sociol. 281—African Society and Culture.
- Sociol. 290—Special Topics in Anthropology.

College of Business and Economics

- Econ. 210—Comparative Economic Systems.
- Econ. 213—Economic Development. (Same as Agr. Econ. 213).
- Econ. 219—Seminar in Economics.
- Econ. 375—Economic Development.
- Econ. 379—Seminar in Economic Development.

Creative Arts Center

Division of Music

- Music 230—Music of Africa.

College of Engineering

- Agr. Eng'g. 420—Special Topics.
- Agr. Eng'g. 497—Research.

College of Human Resources and Education

Division of Education

- C & I 270—Special Problems in Comparative Education.

Committee on Public Affairs Programs

Established in 1969 by the President, this committee has University-wide responsibility for developing teaching and research programs in public affairs. It is especially concerned with policies governing direction of programs leading to the degree of Master of Public Administration and those of the Bureau for Government Research.

Committee members are: O. B. Conaway, Jr., (*Chairman*); Homer C. Evans, Leo Fishman, Harold A. Gibbard, Ray Koppelman, Benjamin Linsky, William H. Miernyk, Robert F. Munn, Ralph E. Nelson, Robert L. Nolan, Harry K. Schwarzweller, Paul L. Selby, and John C. Wright.

University Environmental Council

The University Environmental Council identifies local, regional and national environmental problems, determines the extent of the University's involvement in these problems and recommends to the University President programs of research, instruction, and service to deal with them.

The Council maintains an inventory of the University's relevant resources, develops broad guidelines which insure the involvement of the University in environmental problems within the scope of the Council's assignment, and recommends policy to the President.

Council members are: Chester A. Arents (*Chairman*); Richard P. Smith (*Secretary*); Charles H. Baer, Sam Colvin (*Student*); Charles R. Jenkins, Edwin C. Keller, Ray Koppelman, Norman G. Kowal, Benjamin Linsky, Marilyn E. Lugar, Harold M. McNeill, William H. Miernyk, Robert W. Miller, Earle P. Shoub, Robert L. Smith, and Raymond D. Zinn.

Regional Research Institute

The Regional Research Institute was established in 1965 to facilitate the research of faculty members and advanced graduate students in economics and other social sciences. The Institute cuts across college and departmental lines. Much of the work completed under Institute auspices to date has related to West Virginia or Appalachia, but there are no geographical restrictions on Institute projects. These may deal with any aspect of social or economic analysis as long as a spatial dimension is involved.

Black Studies Committee

This committee works to expand the number and scope of course offerings in black studies. Members are Nelson Bickley, black student adviser and foreign student coordinator; Robert Davis, assistant professor of geography; Douglas Sheppard, director of foreign language teaching; Judith Stitzel, assistant professor of English; Leon Williams, assistant professor of social work; Rodger Yeager, assistant professor of political science; and two students.



Agricultural Biochemistry Laboratory

PART 6

GRADUATE FACULTY

Ex officio members: The President of the University, the Vice-Presidents, the Provosts, and Deans of the various colleges and schools.

Asterisk following name designates Associate Member.

COLLEGE OF AGRICULTURE AND FORESTRY

Faculty of Agricultural Biochemistry

- David A. Stelzig, Ph.D. (N. Dak. St. U.), *Assistant Professor of Agricultural Biochemistry, Chairman.*
- Bradford C. Bearce, Ph.D. (U. Calif.), *Assistant Professor of Horticulture and Agricultural Biochemistry.*
- James L. Brooks, Ph.D. (U. Calif.), *Assistant Professor of Agricultural Biochemistry.*
- Morris Ingle, Ph.D. (Purdue U.), *Associate Professor of Horticulture and Agricultural Biochemistry.*
- Walter J. Kaczmarczyk, Ph.D. (Hahnemann Med. C.), *Assistant Professor of Genetics and Agricultural Biochemistry.*
- George A. McLaren, Ph.D. (Okla. St. U.), *Professor of Nutritional Biochemistry.*
- William G. Martin, Ph.D. (WVU), *Associate Professor of Agricultural Biochemistry.*
- Homer Patrick, Ph.D. (Penn. St. U.), *Professor of Agricultural Biochemistry.*
- Robert L. Reid, Ph.D. (Aberdeen U.), *Professor of Animal Nutrition and Agricultural Biochemistry.*
- Eion G. Scott, Ph.D. (U. Calif.), *Professor of Horticulture and Agricultural Biochemistry.*
- Valentin Ulrich, Ph.D. (Rutgers U.), *Professor of Genetics and Agricultural Biochemistry.*

Division of Animal and Veterinary Sciences

- Alfred L. Barr, Ph.D. (Okla. St. U.), *Professor of Agricultural Economics; Director.*
- Gerald C. Anderson, Ph.D. (U. Mo.), *Professor of Animal Science.*
- Leslie Dozsa, D.V.M. (C. Vet. Med., Budapest), *Professor of Veterinary Science.*
- Robert S. Dunbar, Jr., Ph.D. (Cornell U.), *Professor of Animal Science; Dean of College of Agriculture and Forestry.*
- Donald J. Horvath, Ph.D. (Cornell U.), *Professor of Animal Science.*
- E. Keith Inskeep, Ph.D. (U. Wisc.), *Associate Professor of Animal Science.*
- Robert O. Kelley, Ph.D. (U. Mo.), *Associate Professor and State Extension Specialist—Dairy Science.*
- Harold E. Kidder, Ph.D. (U. Wisc.), *Professor of Animal Science.*
- Marvin R. McClung, Ph.D. (Iowa St. U.), *Professor of Animal Science.*
- George A. McLaren, Ph.D. (Okla. St. U.), *Professor of Nutritional Biochemistry.*
- William G. Martin, Ph.D. (WVU), *Associate Professor of Agricultural Biochemistry.*
- Norman O. Olson, D.V.M. (Wash. St. U.), *Professor of Veterinary Science.*
- Homer Patrick, Ph.D. (Penn. St. U.), *Professor of Agricultural Biochemistry.*
- John B. Peters, Ph.D. (U. Wisc.), *Assistant Professor of Animal Science.*
- Ronald A. Peterson, Ph.D. (Mich. St. U.), *Assistant Professor of Poultry Science.*
- Robert L. Reid, Ph.D. (Aberdeen U.), *Professor of Animal Science.*
- John R. Schabinger, Ph.D. (N.C. St. U.), *Associate Professor and Area Extension Specialist—Dairy Science.*

William V. Thayne,* Ph.D. (U. Ill.), *Assistant Professor of Animal Science.*
 Roy O. Thomas, Ph.D. (Mich. St. U.), *Assistant Professor of Dairy Science.*
 Benjamin W. Wamsley, Jr.,* M.S. (WVU), *Associate Professor and State Extension Specialist—Animal Science.*
 James A. Welch, Ph.D. (U. Ill.), *Professor of Animal Science.*
 Frank E. Woodson,* D.V.M. (Ohio State U.), *Associate Professor of Veterinary Science.*

Division of Forestry

David E. White, Ph.D. (St. U. N.Y.), *Associate Professor of Forest Economics; Director.*
 Samuel M. Brock, Ph.D. (U. Minn.), *Associate Professor of Forest Economics.*
 Kenneth L. Carvell, D.F. (Duke U.), *Professor of Silviculture.*
 Franklin C. Cech, Ph.D. (Tex. A. & M. U.), *Professor of Forest Genetics.*
 John D. Gill,* M.S. (Mich. St. U.), *Assistant Professor of Wildlife Management.*
 William H. Goudy,* M.S. (Mich. St. U.), *Assistant Professor of Wildlife Management.*
 John R. Hamilton, Ph.D. (N.C. St. U.), *Professor of Wood Science.*
 Joseph M. Hutchison, Jr.,* M.S. (WVU), *Associate Professor of Recreation.*
 Norman D. Jackson,* M.W.T. (N.C. St. U.), *Assistant to the Director; Associate Professor of Wood Science.*
 Etley P. Jenkins,* M.S. (WVU), *Instructor in Wood Science.*
 Laszlo O. Keresztesy, Ph.D. (U. London), *Research Associate.*
 Christian E. Koch, Ph.D. (U. Mich.), *Professor of Wood Science.*
 Richard Lee, Ph.D. (Colo. St. U.), *Associate Professor of Forest Hydrology.*
 Edwin D. Michael, Ph.D. (Tex. A. & M. U.), *Associate Professor of Wildlife Biology.*
 Peter R. Mount, Ph.D. (Colo. St. U.), *Assistant Professor of Forest Economics.*
 David E. Samuel,* Ph.D. (WVU), *Assistant Professor of Wildlife Management.*
 Robert L. Smith, Ph.D., (Cornell U.), *Professor of Wildlife Biology.*
 Hans-Peter Steinhagen,* Diplom-Holzwirt (U. Hamburg), *Assistant Professor of Wood Science.*
 Earl H. Tryon, Ph.D. (Yale U.), *Professor of Silviculture.*

Division of Plant Sciences

Mannon E. Gallegly, Jr., Ph.D. (U. Wisc.), *Professor of Plant Pathology; Director.*
 Robert E. Adams, Ph.D. (Cornell U.), *Associate Professor of Plant Pathology.*
 Barton S. Baker,* Ph.D. (WVU), *Assistant Professor of Agronomy.*
 John A. Balasko,* Ph.D. (U. Wisc.), *Assistant Professor of Agronomy.*
 Horace L. Barnett, Ph.D. (Mich. St. U.), *Professor of Mycology.*
 Bradford C. Bearce, Ph.D. (U. Calif.), *Assistant Professor of Horticulture.*
 James L. Brooks, Ph.D. (U. Calif.), *Assistant Professor of Agricultural Biochemistry.*
 Linda Butler, Ph.D. (U. Ga.), *Assistant Professor of Entomology.*
 William H. Childs, Ph.D. (Cornell U.), *Professor of Horticulture.*
 Edward S. Elliott, Ph.D. (WVU), *Professor of Plant Pathology.*
 Morris Ingle, Ph.D. (Purdue U.), *Associate Professor of Horticulture.*
 Everett M. Jencks, Ph.D. (Rutgers U.), *Associate Professor of Agronomy.*
 Walter J. Kaczmarczyk, Ph.D. (Hahnemann Med. C.), *Assistant Professor of Genetics.*
 Robert F. Keefer, Ph.D. (Ohio St. U.), *Associate Professor of Agronomy.*
 Wayne N. Millar,* Ph.D. (Penn St. U.), *Assistant Professor of Bacteriology.*
 Joginder Nath, Ph.D. (U. Wisc.), *Associate Professor of Genetics.*
 Oliver M. Neal, Ph.D. (Mich. St. U.), *Professor of Horticulture.*
 Oscar E. Schubert, Ph.D. (U. Ill.), *Professor of Horticulture.*

*Associate Member

Eion G. Scott, Ph.D. (U. Calif.), *Professor of Horticulture.*
 Richard M. Smith, Ph.D. (Ohio St. U.), *Professor of Agronomy.*
 David A. Stelzig, Ph.D. (N. Dak. St. U.), *Assistant Professor of Agricultural Biochemistry.*
 Valentin Ulrich, Ph.D. (Rutgers U.), *Professor of Genetics.*
 Harold A. Wilson, Ph.D. (Iowa St. C.), *Professor of Bacteriology.*
 Robert J. Young,* Ph.D. (Ore. St. U.), *Assistant Professor of Plant Pathology.*

Division of Resource Management

Kenneth D. McIntosh, Ph.D. (U. Wisc.), *Professor of Agricultural Economics, Director.*
 Russell C. Butler, Ph.D. (Cornell U.), *Professor of Agricultural Education and Education.*
 James H. Clarke, Ph.D. (U. Minn.), *Professor of Agricultural Economics.*
 Dale K. Colyer, Ph.D. (U. Wisc.), *Professor of Agricultural Economics.*
 Homer C. Evans, Ph.D. (U. Minn.), *Professor of Agricultural Economics.*
 Kenneth J. Hock, M.S. (U. Wisc.), *Assistant Professor of Agricultural Economics.*
 Robert L. Jack, Ph.D. (Penn St. U.), *Associate Professor of Agricultural Economics.*
 Warren G. Kelly, Ed.D. (U. Mo.), *Associate Professor of Agricultural Education and Education.*
 John P. Kuehn,* Ph.D. (U. Tenn.), *Assistant Professor of Agricultural Economics.*
 O. Claude McGhee, Ph.D. (Ohio St. U.), *Associate Professor of Agricultural Education.*
 Ralph E. Nelson, Ph.D. (U. Minn.), *Professor of Agricultural Economics.*
 Ernest J. Nesius, Ph.D. (Iowa St. U.), *Professor of Agricultural Economics.*
 Paul E. Nesselroad,* Ph.D. (Penn. St. U.), *Associate Professor of Agricultural Economics.*
 George Toben, M.S. (U. Ill.), *Professor of Agricultural Economics.*

COLLEGE OF ARTS AND SCIENCES

Biology

E. C. Keller, Jr., Ph.D. (Penn. St. U.), *Professor; Chairman.*
 Lila Abrahamson, Ph.D. (U. Mich.), *Associate Professor.*
 Charles H. Baer, Ph.D. (U. Md.), *Associate Professor.*
 Jay Barton II, Ph.D. (U. Mo.), *Professor; Provost for Instruction.*
 Herald D. Bennett, Ph.D. (U. Iowa), *Professor.*
 Arnold Benson,* M.A. (U. Colo.), *Assistant Professor.*
 Robert L. Birch,* M.S. (Penn. St. U.), *Assistant Professor.*
 David F. Blaydes, Ph.D. (Ind. U.), *Associate Professor.*
 W. Newman Bradshaw, Ph.D. (U. Tex.), *Associate Professor.*
 Carol S. Carter-Porges, Ph.D. (U. Ark.), *Adjunct Assistant Professor.*
 Roy B. Clarkson, Ph.D. (WVU), *Professor; Associate Chairman.*
 Jesse F. Clovis, Ph.D. (Cornell U.), *Associate Professor.*
 William E. Collins, Ph.D. (U. Wisc.), *Associate Professor.*
 Mullen O. Coover,* M.S. (WVU), *Assistant Professor.*
 Earl L. Core, Ph.D. (Columbia U.), *Professor.*
 John J. DeCosta, Ph.D. (Ind. U.), *Assistant Professor.*
 Dorothy Covalt Dunning, Ph.D. (Tufts U.), *Assistant Professor.*
 Ramsey H. Frist, Ph.D. (U. Pitt.), *Assistant Professor.*
 Lloyd R. Gribble, Ph.D. (WVU), *Professor; Associate Dean.*
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Wildlife management 60

Wood science 59

WVU Foundation fellowships 19

West Virginia University cultural attractions encompass all the arts—ranging from performances by internationally recognized artists to the expertly done productions of the Creative Arts Center. Events attracting as many as 13,500 people are held in the Coliseum. Semester and weekly calendars of WVU events carry listings of exhibits, lectures, plays, concerts, operas, cinema classics, and other cultural events.



Scene from University Opera Theatre production of "La Boheme"

Creative Arts Center



